the OIL AND GAS JOURNAL
PUBLISHED WEEKLY FEBRUARY 20, 1961

Exclusive survey shows how refiners are combating

AIR POLLUTION p. 105

Refiners shift yields—and still have problems ▸ 77

Brown-Bassett: Growing gas giant ▸ 80

In Venezuela . . .

A dormant industry awaits uncertain future ▸ 100

Magnolia field goes automatic ▸ 144

Four Corners keeps helium production lead ▸ 194

The vessel, 227 feet, 6 inches long, leaving Wyatt's Houston plant, as the longest rail cargo ever hauled.

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  COMPLETE WITH SKIRT, BASE PLATE AND ALL NOZZLES AND FITTINGS ATTACHED
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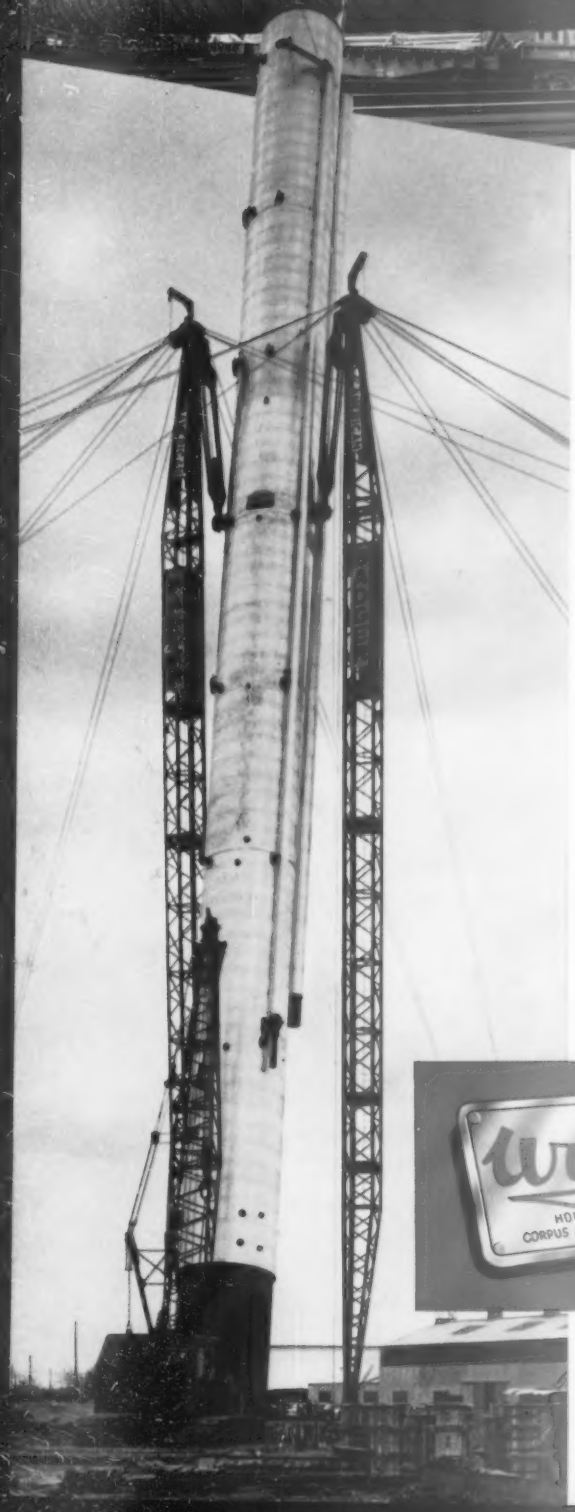
- *TALLEST TOWER EVER ERECTED IN ONE PIECE*



Final stages of record lift by Badger Manufacturing Company in the petrochemical plant of Sinclair-Koppers Chemical Company.

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OIL AND GAS JOURNAL
Vol. 59, No. 8

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The Oil and Gas Journal is published weekly by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa 3, Okla. Second-Class postage paid at Tulsa, Okla. Copyright 1961 by The Petroleum Publishing Co. United States and foreign rates to the petroleum industry, 1 year $5, 2 years $8, 3 years $10.

TECHNOLOGY–OPERATION

Refining-Processing

SPECIAL SECTION: How Refiners are Combating Air Pollution . . **105**

By D. H. Stormont

Based on information from refiners accounting for 83% of the U. S. plant capacity, about $12.7 million will be spent for control measures this year. Biggest expenditures are for controlling hydrocarbons, most of which are saturated compounds. Role of these compounds as pollutants is still questionable. Research on air-pollution control will total more than $1 million this year. Half will be for intercompany-sponsored research, and the other half will be spent by oil companies in conducting their own research.

New Design Boosts Alkylate Quality **120**

By W. F. Vernon and C. E. Baechler

New Perco unit makes 106.5 leaded-motor-octane debutanized alkylate when operating on mixed propylene-butylene feed.

Process Costimating—89 . . . . . **130**

Sweetening processes based on oxidation of mercaptans to disulfides.

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Things to watch in combustion.

Pipelining

Deep Ground Beds Protect Bare Lines **117**

By J. P. O'Donnell

The deep beds do a better job of cathodically protecting bare lines than do conventional beds. Interstate Oil Pipe Line's corrosion engineers have come to this conclusion after more than 3 years experience with 30 installations.

How to Repair an Operating Pipeline **155**

By J. P. O'Donnell

Here are five steps used for repairing a section of operating 24-in. crude-oil pipeline in the Sahara.

Drilling-Production

What We Know About Foam Drilling **125**

By A. S. Murray and J. E. Eckel

This technique can handle larger flows of formation water than is generally realized. Careful evaluation of fluid-flow properties and the injection of precise amounts of additives at controlled rates are necessary.

Magnolia Field Goes Automatic **144**

By W. B. Bleakley

Features of the automatic system in use on 4,300 acres in Magnolia field are (1) four test centers metering oil to a central facility, (2) gas measurement by p.d. meters, (3) programed automatic well testing, (4) separate handling facilities, and (5) vapor-recovery system on the surge tank.

General

Economics of a Sound Safety Program—3 . . . . . **133**

By James H. Herbert

Establish safety as an independent function by having the safety department report directly to the manager or assistant manager. Make the safety post a key training spot for outstanding men.

Oil Imports to Europe are Increasing **138**

By M. E. Hubbard

One-half of the future growth in Europe's energy requirements will be met by increased oil imports. Over the next 15 years or so these can be expected to grow by 10 to 11 million tons each year, on the average.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Feb. 20, 1961

Oil profits should remain high through midyear:

Investment analysts report earnings being made by integrated companies in the first quarter of 1961 are the best in 3 years.

They attribute the profits gains to two trends: Corrective measures taken last year and this winter's extremely cold weather. Result was increased refiner's spread and a booming demand for fuel oil—a combination which boosts profits.

Over the long haul, they see domestic earnings holding good levels but foreign earnings facing some trouble.

▼ ▼ ▼

Refiners, however, are learning that profitable winter business may cause them trouble this summer.

Refining runs hit record highs in January. They were needed to meet heavy demand for distillates. At the same time, refiners tried to avoid heavy gasoline production by shifting yields to distillates.

Gasoline production did fall below year-earlier levels but stocks still rose above totals for the same period.

The reasons: Same cold weather that boomed demand for heating oils also cut down motoring and demand for gasoline. Stocks of gasoline also were too high at the start of the winter because of excessive production last summer (p. 77).*

Key to summer business will be what happens in the approaching twilight time of demand. Need for heating will start easing off, and it's too early for motoring season to create big demand for gasoline. Stage is so set now that continued heavy gasoline stockpiling could break prices and hurt profits until the last quarter.

▼ ▼ ▼

Rotary rig activity remains in the doldrums.

Only 1,479 rigs were at work last week. It was a new low mark for the year and the lowest activity since 1946 when postwar shortages prevented rapid rise in domestic drilling.

By way of comparison, 1,618 rigs were busy at this time in 1960.

Important confirmation well to Anido Creek discovery has been

---

*Refers to article in this issue giving more details. When no page is given, the item is a Newsletter exclusive.

completed, flowing 501 bbl. of 41.6°-gravity oil through choke from lower Ismay Pennsylvanian perforations at 5,360-80 ft.

Well is Champlin 2 Navajo-III in San Juan County, Utah. It is southwest offset to Champlin's big 2,085-bbl. per day discovery in Anido Creek. Humble is drilling at 5,631 ft. at a northwest offset.

Anido Creek is considered the biggest oil strike in this portion of the Paradox basin since the early days of Aneth development.

Pan American expects to drill 12 to 14 wildcats this winter on its 5,500,000-acre Caribou Mountain holdings in far northern Alberta, largest single block in the province.

Company got show recently at its A-1 Melvin River near middle of the block. When sulfur and salt water flowed in later testing of the Slave Point Devonian, drilling was continued deeper. Pan Am so far has two dry holes in the region, two drilling, two staked. The area is about 400 miles northwest of Edmonton.

Wellhead assembly capable of an octuple completion has been designed by Sunray Mid-Continent and built by Oil Center Tool.

The christmas tree can produce through four dual strings from eight sands. It is installed on a well in McFaddin field of South Texas but is finaled for production from only five sands (p. 83).

Depth records for their diameters probably have been set by two strings of casing run by John W. Mecom crews in Louisiana.

A string of 15,644 ft. of 9⅝-in. casing was set on a semi-wildcat in Lake Washington field. A string of 13,023 ft. of 10¾-in. was run in Mecom's ultradeep well which may go to 26,000 ft.

▲ ▲ ▲

Interior Secretary Stewart Udall's review of last-minute oil decisions by the Eisenhower administration may not result in changes.

In Washington, Udall has given the impression that the decision opening residual imports to companies without a record of importing in 1957 might be rescinded. Hearing on the entire residual program starts in Washington today.

Word among importers, however, is that the decision to cut back existing importers 15% and allocate this share to new importers will stand.

Canadian majors on the whole are pleased by the government's acceptance of a compromise plan for increasing markets for domestic crude and liquids.

Privately they say the 1963 goal of 800,000 bbl. daily production is attainable. However, most are nervous about the short-term goals for mid-1961 and the full year. These are not considered likely of achievement.

The near goals appear to have been a political gesture toward elements demanding more drastic action to increase Canadian markets. And companies expressing concern hope that a failure to reach short-term goals will not bring on threatened imports controls.

A sizable tariff advantage is claimed by Interprovincial Pipe Line over a proposed Alberta-Chicago natural-gas liquids line.

Interprovincial has offered to extend its system from Superior to Chicago if the demand develops. It can batch condensates and other liquids in its crude system for 55 cents at 20,000-bbl. daily rate and 44 cents at 50,000 bbl. daily. Reported rate for proposed Indiana Standard-Pembina line is 80 cents.

Pakistan has agreed to a Russian exploration deal.

Pakistani officials reportedly accepted less favorable terms than those offered by Western companies. The explanation: Russians offered low-interest, long-term financing, and Pakistan was disappointed at failures of private ventures.

▼ ▼ ▼

Computer-controlled petrochemical plant is due to go on stream later this year. UOP is designing the automatic plant but company Chairman M. P. Venema declines to identify the operator.

Look for early announcements of refinery-expansion—and perhaps a completely new refinery—in Ontario as a result of the new oil policy in Canada.

Good candidate for expansion is Regent (Texaco). Shell also may soon disclose plans for a new plant in the Toronto area.

State taxes paid by highway users amount to 27.1% of total state tax receipts, U. S. Department of Commerce records show.

Levies on highway users total $4,888 billion. Total state tax receipts are $18 billion.

Biggest burden is motor-fuel taxes which total $3,322 billion over the 50 states.

Nebraska's highway users pay 49.3% of all state taxes for the biggest share in the country. New Hampshire's highway users pay 48.9% of all taxes, New Jersey's 46.3% and South Dakota's 40.1%.

▼ ▼ ▼

Industry notes: Plans to merge Douglas Oil into Continental have been completed, giving the Conoco brand a chance to expand into California (p. 90)...Elimination of grease fittings on U. S. passenger cars may come as early as 1963. It means an even steeper drop in automotive grease consumption (p. 84)...U. S. refiners are spending another $12,700,000 this year in their attack on air pollution, bringing the 6-year investment in this program to $105,000,000 (p. 105). Median salary for all engineers is now $9,600, sharply up from the $6,500 in 1953. Median age of engineers is 32...Firmer tanker rates are making Tapline more popular for moving Saudi Arabian crude to the Mediterranean coast. January deliveries from the Sidon terminal averaged 385,063 bbl. daily, highest since March 1959 ...Fairly stable prices at the wellhead for natural gas are forecast in next decade by El Paso Natural President Paul Kayser. He expects the rising price trend of recent years to level off.

Market Memo

Feb. 20, 1961

An uneasy lull has settled over petroleum markets.

That's especially true of No. 2 and gasoline.

Warm weather has made buyers cautious on late deliveries of all distillates in all markets. It's getting late in the season now, and bulk of winter demand has been served. But remember last year's March blizzards—there's still chances for some more heating oil weather. Buyers will play closer to their chest from here on out.

As for gasoline, there's just very little interest in it now. Buyers know plenty of motor fuel lies in storage and the price probably will be right when they want it.

The Mississippi River and Gulf Coast spot markets particularly have a deflated look after the hectic activity of past few weeks.

Interest is gone in buying No. 2 for down-river movement. An offer to sell 200,000 bbl. of No. 2 for midriver loading to barge into the Gulf about mid-March went begging last week. The delivery date was just too late.

The spot market for No. 2 on the Gulf is cleaned up through rest of February, and March liftings attract little interest.

None is talking gasoline either on the River or at Gulf points. Most recent offerings at river ports were one-half cent off Gulf lows. Prices on the Gulf are being described as one-half to three-fourths of a cent off postings, but that's academic because there are no spot buyers.

Kerosine markets also are quiet on the Gulf—there's too much of it. No. 6 is still tight and booked up through April. There are practically no spots in this material. The last reported deal involved a major refiner who got two cargoes of No. 2 in turn for selling two cargoes of residual.

Higher East Coast distillate prices have taken hold. They stirred up a hornet's nest of customer and political protests but from an economic standpoint were considered overdue.

A lull in the severe cold has loosened harbor areas and enabled supplies to go through.

The market for heating oils is generally firm. Some discounting continues off the new prices in Boston, Providence, and Baltimore; but this has been the case throughout the heating season.

Gasoline continues to be depressed in spots but is reasonably stable considering the season.

Along the Great Lakes Pipe Line, distillates now are being discounted one-fourth cent off postings, and volume buyers might do better. Gasoline is discounted in a range from one-fourth to three-fourths of a cent off. In Chicago, distillates are discounted one-fourth of a cent and gasoline easily a half cent.

Good Wells Make Good News

Reports Showing How Dowell Helped Operators Improve Wells

February 20, 1961

Here are four recent cases showing how Dowell products and services have helped operators increase net profits from wells.

- Calcasieu Parish, South Louisiana (Old Oil Well) Production from this well had remained 40 bopd with 400 psi flowing pressure during 10 months following completion. Pay was the Miocene from 10,528 to 10,542 feet. The operator suspected mud damage to the formation. Dowell injected 40 gallons of Mudban* in 2000 gallons crude followed by a flush containing a Dowell foaming agent for oil. Treatment was performed with Christmas tree in place. After treatment, well flowed 8 to 10 barrels mud, then cleaned up. Production rose to 120 bopd with 1200 psi flowing pressure.

- Barber County, Kansas (Abandoned Oil Well) This well in the Rhodes pool had been down for eight months. Pumping unit, rods and tubing had been removed and the well had been sold to the present owner for salvage. Dowell treated well with Blue Paraffin Solvent; a Dowell solvent designed for paraffins containing asphaltic material. Before treatment, a swab test showed no fluid. 50 gallons of Paraffin Solvent and 1000 gallons kerosene were circulated and then displaced into the formation. After treatment, well swabbed 13 bopd and was put on pump.

- Upton County, West Texas (New Oil Well) This well was completed open hole into the Ellenburger between 12,311 and 12,327 feet. The formation would not break down at 5000 psi -- the permissible surface working pressure. The operator decided to use Rockshock* implosion service to reduce breakdown pressure. Dowell ran four 10-inch glass capsules and imploded them opposite the pay. Formation then accepted 7500 gallons acid down two-inch tubing at 4100 psi and 3 bpm. Before treatment, the well swabbed dry. After treatment, it flowed 354 bopd through a 20/64-inch choke.

- Wayne County, Illinois (Old Oil Well) The operator of this pumping well had been plagued with rod breaks. Production of 5 bopd and 50 bwpd was from the Aux Vases sand. Thirty-five ⅝-inch rods had to be replaced during the twelve-month period before Dowell was asked to start a corrosion inhibitor treating program. One pint of Corban* 207 was dumped down casing every other day. There was not a single rod break during the first year after treating was begun. Down-hole equipment and tubing also remained in good condition. Treatment cost was only $60.00 per year.

Talk your production problems over with your Dowell representative. The chances are good he can help you improve production or decrease costs with Dowell products or services. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, Germany, France and the Sahara area. Dowell, Tulsa 1, Oklahoma.

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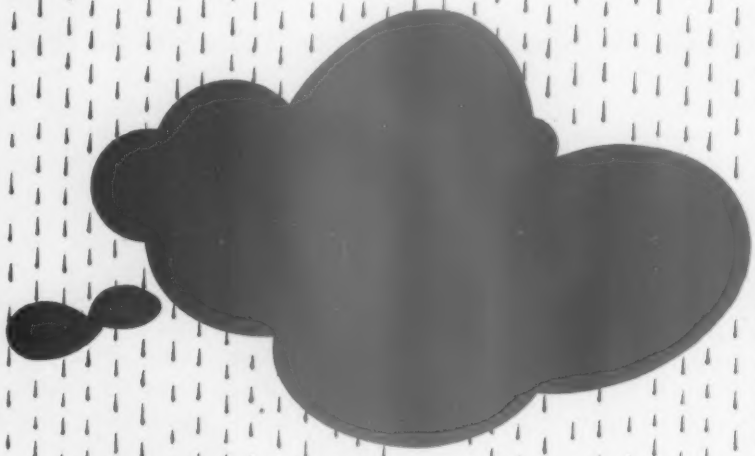

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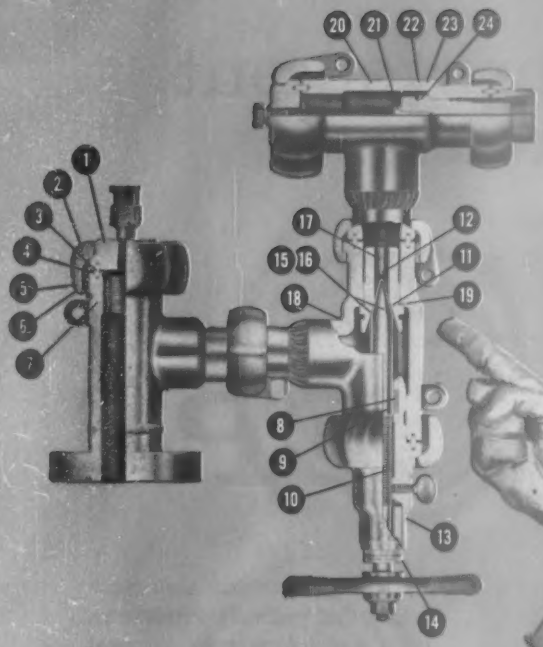

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19. Wing Valve stem seat sealed by power threads and metal gasket assure alignment.
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21. Shaped entrance on beans prevents paraffin clogging.
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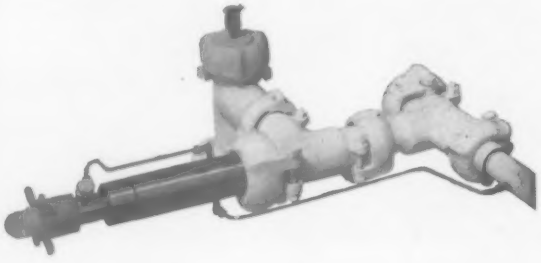

The valve in this manfold is the new UNIBOLT Pressurematic Valve which is a combination automatic high-low safety valve and manually-operated wing valve for choke changing.

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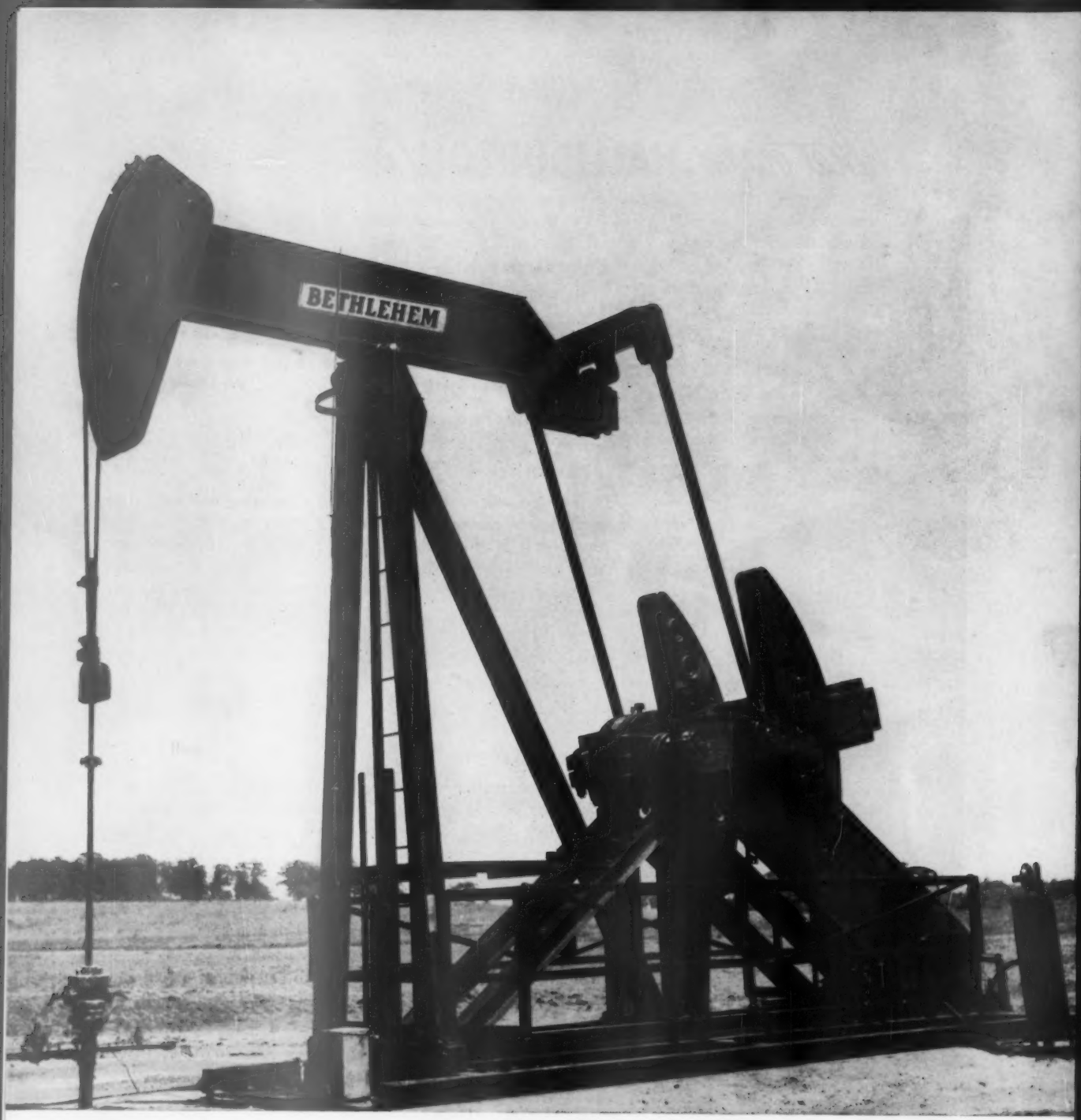

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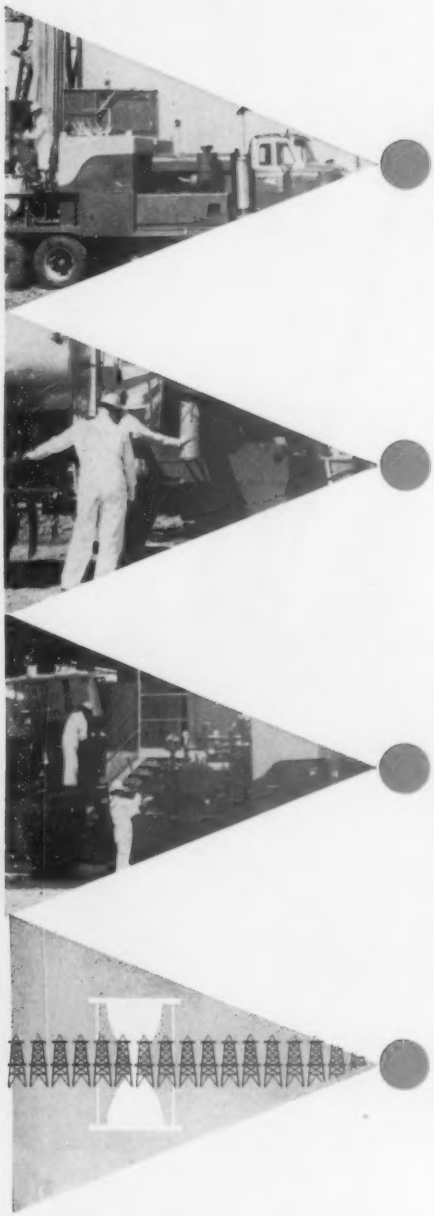

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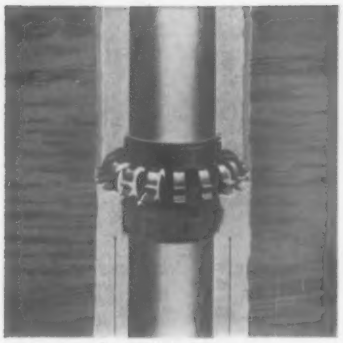
... just minutes away
from your well



Recipo Wall Cleaner Installed with EZ Lok Limit Clamp

RECIPO WALL CLEANER

The wide, tough rubber cleaning fingers of this Halliburton tool more effectively remove undesirable filter or mud cake from the bore hole to allow better bonding of cement. Cement properly bonded to the wall of the hole and casing gives protection to both and usually lengthens the producing life of the well.

CEMENTING PLUGS

The two-plug method using Halliburton's type 5W top and bottom cementing plugs reduces contamination on the interface between mud and cement... Gives better cementing results around bottom of casing where a good bond is required.

5-Wiper Plug — Top

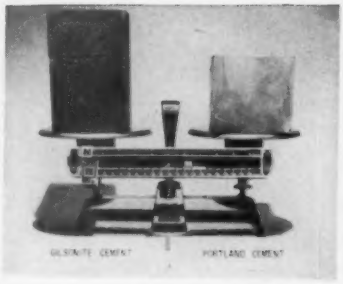
5-Wiper Plug — Bottom

THESE HALLIBURTON PRODUCTS HELP MAKE HALLIBURTON CEMENTING SUPERIOR

GILSONITE CEMENT

Typical of many Halliburton cements and additives is Gilsonite, a light weight, low density additive which adds volume to the cement slurry without adding weight. Its graded particle size offers superior bridging characteristics for better control of lost circulation.

The illustration demonstrates the low-density characteristic of Gilsonite cement. Balancing on the scale are one and one-half cubes of 10.0 pound-per-gallon Gilsonite slurry and only one cube of portland cement made from 15.6 ppg slurry.



S-3 CASING CENTRALIZER

Provides positive centering force to permit more uniform centering around the pipe for maximum strength and minimum cement channeling. Aids in increasing the economical life of the producing formation.

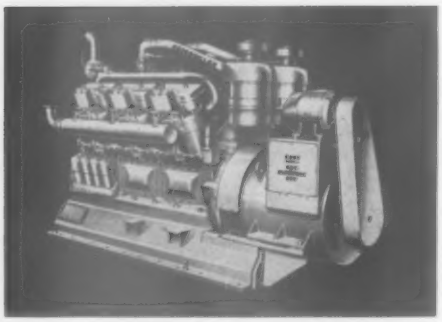
S-3 Casing Centralizer

CEMENTING SERVICES

Halliburton
COMPANY • DUNCAN, OKLAHOMA

engine power
BY CATERPILLAR

IN ONE YEAR, A CAT G397 OPERATING AT FULL LOAD CAN SAVE YOU 6 MILLION CUBIC FEET OF GAS



Reason? *For one thing, Cat Natural Gas Engines* do not *have to be derated for continuous operation. Most other engines do. This fact alone is worth thousands of dollars to you because it means superiority in engine performance, in fuel economy, and in engine life. Here's why . . .*

All Cat Gas Engines are simply turbocharged diesel engines which have been converted to operate on natural gas by lowering the compression ratio, adding spark ignition, carburetion and a few other items. Thus, these engines were of necessity designed for higher internal stresses simply because, as turbocharged diesels, with compression ratios of 16 to 1, they were required to accommodate fuel rates far exceeding those of a gas engine of equivalent displacement. Caterpillar Gas Engines are, therefore, "over designed" for gas operation if measured by the usual industry standards.

Cat's built-in strength, high-quality materials and advanced design allow higher compression ratios—higher compression ratios mean lower fuel consumption. Comparison tests of a 10.5:1 compression ratio Cat G397 with competitive 7:1 compression ratio engines show that the Caterpillar Engine can provide over ¾ million *more* horsepower hours or use 6 million *fewer* cubic feet of gas over a year's period.

In addition to meaningful fuel savings because of high compression ratio, you get a big bonus of horsepower when operating on dry natural gas. For instance, when a naturally aspirated Cat G397 is changed from 7.5:1 to 10.5:1 compression ratio, horsepower goes up 12 per cent. Add a Caterpillar Turbocharger and Aftercooler, and horsepower increases 25 per cent or from 415 to 560 HP over the lower compression ratio engine.

Because Cat Engines are basically designed for *diesel* compression ratios as high as 16 to 1 and for about 1½ times the peak pressures of other gas engines, they just naturally last a long time. But there's more to the story than design. Here's what Caterpillar does to the G397 components to make sure of a long-lived natural gas engine:

Block—30,000 to 40,000 PSI tensile strength . . . good microstructure . . . complete block cleaning . . . multiple rib structure.

Crankshaft—super finished within 7 millionths of true surface . . . separate counterweights for grain flow strength . . . generous ¾" journal fillet to reduce stress concentration.

Liners—.412" wall thickness . . . maximum of 10 per cent ferrite content . . . induction hardened and etched.

Piston—lightweight, low silicon aluminum alloy . . . cast-in iron ring band . . . compact design . . . thicker sections.

Piston Pin—high manganese, high carbon steel for completely hardened core . . . essential toughness remains.

Rings—compression ring has .010" depth of chrome plating on outside for wear resistance . . . oil ring has .005" . . . spring loading of chromium-plated oil ring provides greater sealing pressure against liner wall.

Bearings—steel-backed aluminum alloy for both main and connecting rod bearings . . . higher load carrying capacity . . . resistant to corrosive substances found in crankcases.

Connecting Rods—hardened for toughness . . . contour grinding, forged weight balancing lugs . . . bolts free but snug.

Camshafts—one-piece forged steel . . . flattened exhaust lobe crown for quick-open, hold-open and quick-close action to remove burned gases efficiently.

Valves—induction hardened down stem to prevent cracking . . . tri-metal exhaust, bi-metal intake to resist thermal shock, oxidation and hammering effect . . . controlled valve rotation prevents burning and sticking.

The fact that Caterpillar has been designing, building and *improving* diesel and gas engines for over 30 years is one more reason you can confidently choose a Cat Natural Gas Engine.

A comparison of both initial engine price and parts prices reveals that it costs less to own Cat Gas Engines. And we don't believe that you'll find better backup for service and parts than Caterpillar Dealers. Ask your equipment manufacturer to supply Cat Natural Gas Engines on original equipment. Ask your Cat Dealer to show you the new film on benefits of Cat Natural Gas Engines.

CATERPILLAR

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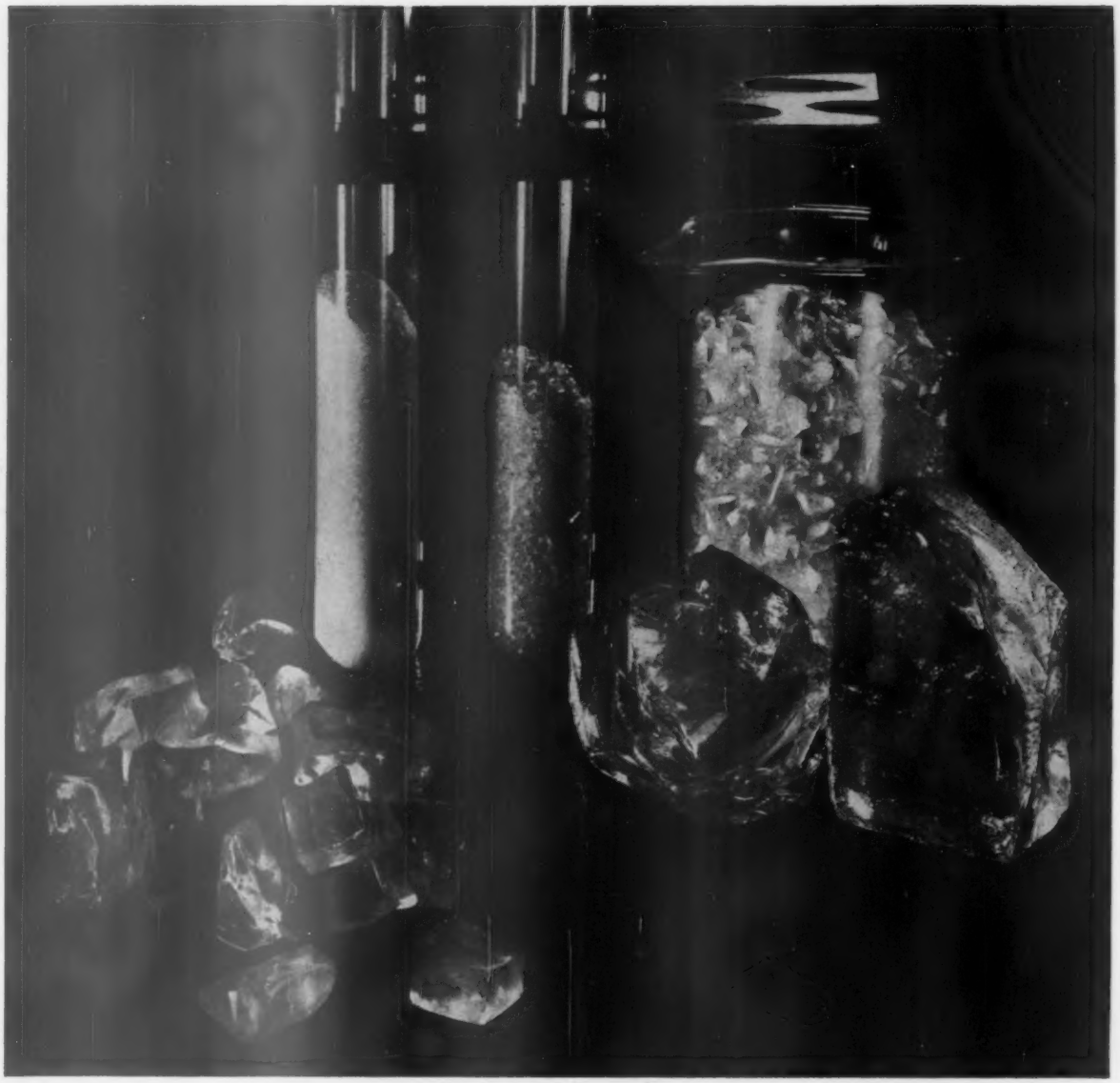
Engine Division, Caterpillar Tractor Co., Peoria, Illinois



Hagan Controlled Solubility Phosphates

accurately maintain phosphate residuals

Complex phosphates, particularly the sodium-calcium glasses, have long been known to provide excellent control of scale in waterflood injection systems and producing wells. However, maintaining the desired residual at all points was almost impossible until Hagan developed the Controlled Solubility formulations. Let's take a look at the factors involved.

Naturally, the first step is a complete analysis of the water to be used. Determining factors which influence the selection of a particular type of Controlled Solubility phosphate include total hardness, brine concentration and temperature.

It is now a simple matter to match a Hagan phosphate to the characteristics of the water. With five sizes and three chemical formulations in each size to choose from, a total range of fifteen different solution rates is available. One of these will match most waters precisely.

Available at leading oil field supply stores throughout the United States and Canada, Hagan Controlled Solubility Phosphates offer a real contribution towards maintaining maximum production efficiency. Write for a complete discussion of scale formation and its prevention. Address:

HAGAN
CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PA.

HAGAN DIVISIONS: CALGON COMPANY • HALL LABORATORIES • BRADFORD LABORATORIES • BRUNER CORP.

360°

DISTRIBUTION OF SLURRY FROM THE CEMENTING SHOE GIVES THE BEST START TOWARD A SUCCESSFUL CEMENT JOB

LARKIN GEYSER SHOE

The Larkin Down Geyser Float Shoe is designed so that 60% of the slurry is discharged at a downward angle from the entire periphery of the shoe. This exclusive side-action provides perfect distribution of the slurry as it is discharged from the casing — the first step toward a successful cementing job.

When necessary, Geyser action will effectively jet out bridges or excessive filter cake from the well bore. Available . . . "Through Your Supply Store"

LARKIN PACKER COMPANY

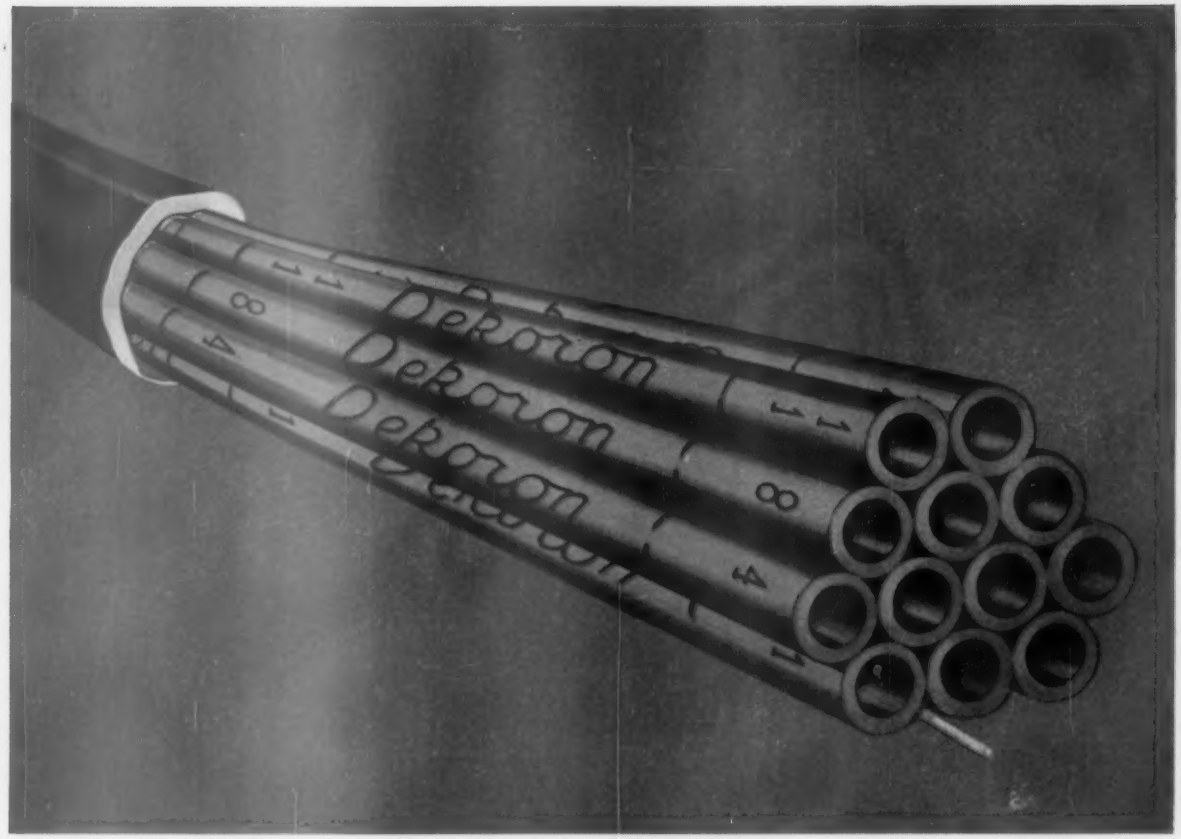
DIVISION KOEHRING COMPANY

WAXAHACHIE, TEXAS

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

LARKIN

...Through Your Supply Store



New Dekoron instrument harness design uses core of Anaconda precision copper tubes

The new parallel-construction Dekoron* "Metl-Cor" instrument harness offers many interesting features. All the tubes are number-coded for faster installation. Because the tubes are parallel, there are no low spots or moisture traps – and as tubes need not be straightened, take-offs are easier to make. The tubes are protected from corrosion and physical damage by a sheath of improved polyethylene. New Dekoron "Metl-Cor," a product of Samuel Moore & Company, Mantua, Ohio, is available in lengths up to 1000 feet.

In this new product, as in other Dekoron instrument tube bundles, Samuel Moore & Co. uses Anaconda Copper Tubing because it consistently meets its rigid quality requirements and is available in unusually long lengths. Special care is taken by Anaconda to maintain dimensional accuracy and uniform soft temper throughout the length. It also makes sure that surfaces are clean, smooth, and bright, free from dirt, dust, or metal chips.

LONG LENGTHS. For such uses as in instrumentation, Anaconda can produce this precision copper tube in coils up to 2200 feet for ¼" O.D.—up to 1400 feet for ⅜" O.D.—and up to 1000 feet for ½" O.D.

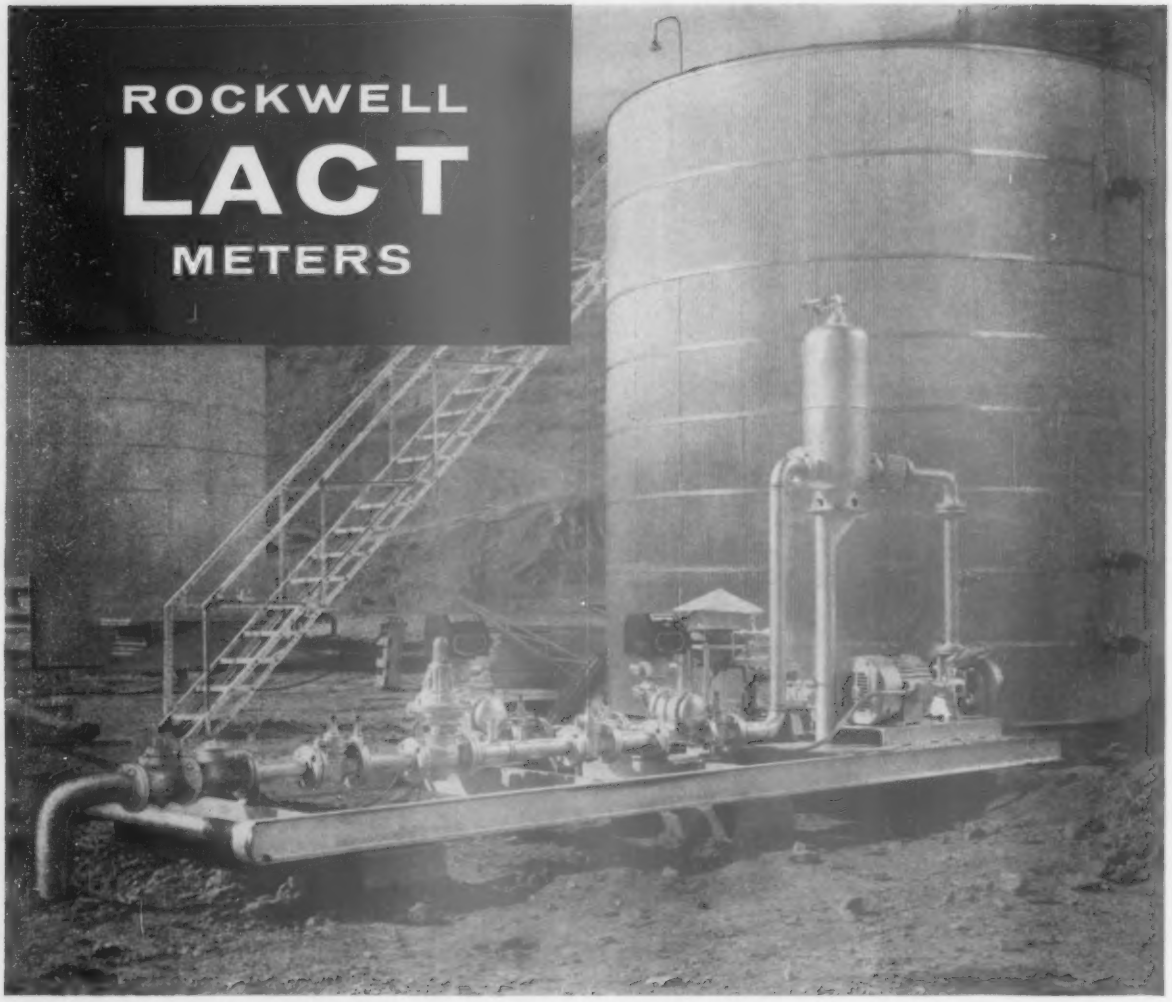
QUALITY TUBE AND CREATIVE TECHNICAL SERVICES. Whatever your requirements for precision copper tubing-instrumentation or capillary tubing, or restrictor tubes – Anaconda specialists can help you find the most economical way to do the job. For such technical assistance, see your Anaconda representative, or write: Anaconda American Brass Company, Box 1031, Waterbury 20, Connecticut.

*Registered trademark of Samuel Moore & Co. 6070

ANACONDA®

INSTRUMENTATION TUBING

Anaconda American Brass Company



Cut transfer costs—
keep records straight

Metered ACT and LACT systems are in your best interests. They provide printed records for proof of conservation control. They lower your operating costs. They verify all quantities transferred. And metered systems provide reliable records for billing purposes as well as firm facts upon which to base royalty and tax obligations.

Rockwell meter systems combine *all* the components you need for protection and savings on your lease. Rockwell meters have an all-revolving measuring mechanism which turns freely on anti-friction bearings without metal-to-metal contact. Rockwell air eliminators insure accurate measurement of liquid volume by removing all entrapped vapors. Automatic temperature compensators translate metered measurement to a uniform base temperature. Ticket printing registers simplify your accounting. Electric impulse contactors actuate remote counters and/or control solenoid valves or pumps for automatic shut-off.

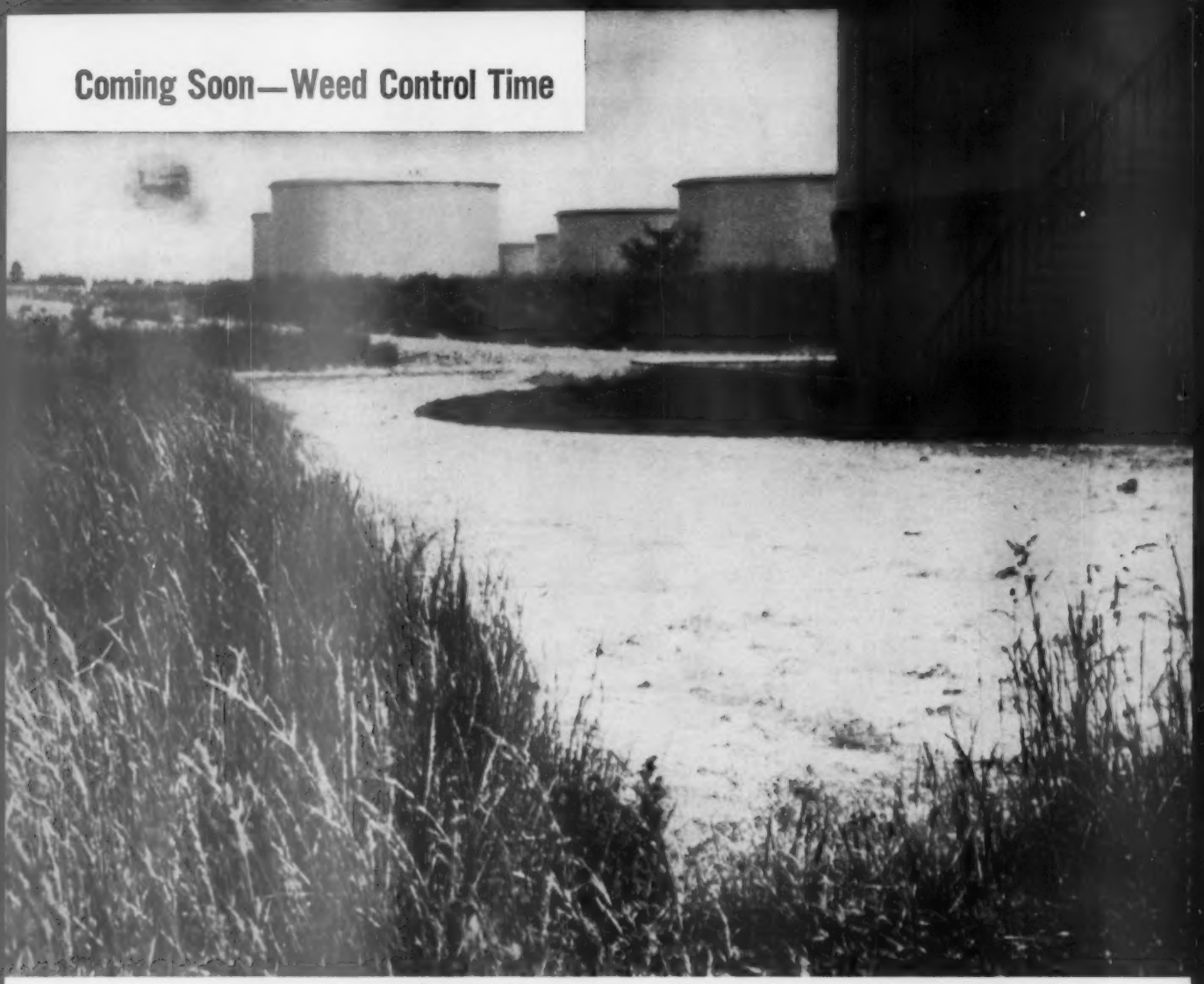
Rockwell meter systems have a proven record of success in oil fields throughout the world. For full facts write: Rockwell Manufacturing Company, Dept. 132B. Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

OIL FIELD METER SYSTEMS

another fine product by

ROCKWELL

Coming Soon—Weed Control Time



The Tidewater Oil Company obtained excellent weed control around storage tanks at their Delaware Refinery by spraying Du Pont Karmex® and Du Pont Trysben® 200. The area was sprayed in the fall of '59—the photograph taken early fall of '60.

Spray a Du Pont Weed Killer once—soon—to eliminate the hazard from fire

Best way to control weeds is to prevent them from getting established. Spray key areas with Du Pont Telvar® monuron or "Karmex" diuron weed killer—just once—right at the start of the season. That way, weeds will be killed, as soon as they sprout, by these chemicals which stay in the soil for an extended period of time to kill through the roots. In addition, spraying early gives you an entire season of freedom from the fire hazards and maintenance difficulties caused by weeds around tanks, pipelines and well areas.

Du Pont also has the answer to the problem of deep-rooted perennials with "Trysben" 200 weed killer. This new weed killer controls tough, broad-leaved perennials by acting through both roots and foliage.

All three of these Du Pont Weed Killers are easy and economical to use. They are also non-flammable and low in toxicity to humans and animals.

Why not plan this year's weed control program right now—and spray soon? A new booklet on Du Pont Weed and Brush Killers and free technical assistance is also available. Just mail the coupon.

On all chemicals follow labeling instructions and warnings carefully.

DU PONT WEED KILLERS

REG. U.S. PAT. OFF.

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E. I. du Pont de Nemours & Co. (Inc.)
Industrial & Biochemicals Department
Room 2543-N, Wilmington 98, Delaware

☐ Please send me your new booklet on Du Pont Weed Killers. ☐ I would like to have assistance in setting up an effective weed control program.

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Title or Position_____

Firm_____

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TOYO KANETSU SETS A NEW RECORD

200

TUBESEALS

TOYO KANETSU, Japan's leading fabricator of steel plate vessels and licensee for Hammond Tubeseal Systems*, sets a new record for Tubeseal installations throughout the Far East... more than 200, ranging in capacity from less than 2,000 barrels to more than 315,000 barrels for safe storage of gasoline, petrochemicals and other volatile products.

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Stone & Webster engineers are justifiably proud of the successful process plants they have designed and constructed around the world. Each adds his full measure of skill and experience to the deep well of knowledge and ability that Stone & Webster can bring to your next process project.

We would welcome the opportunity to discuss how we might help you.

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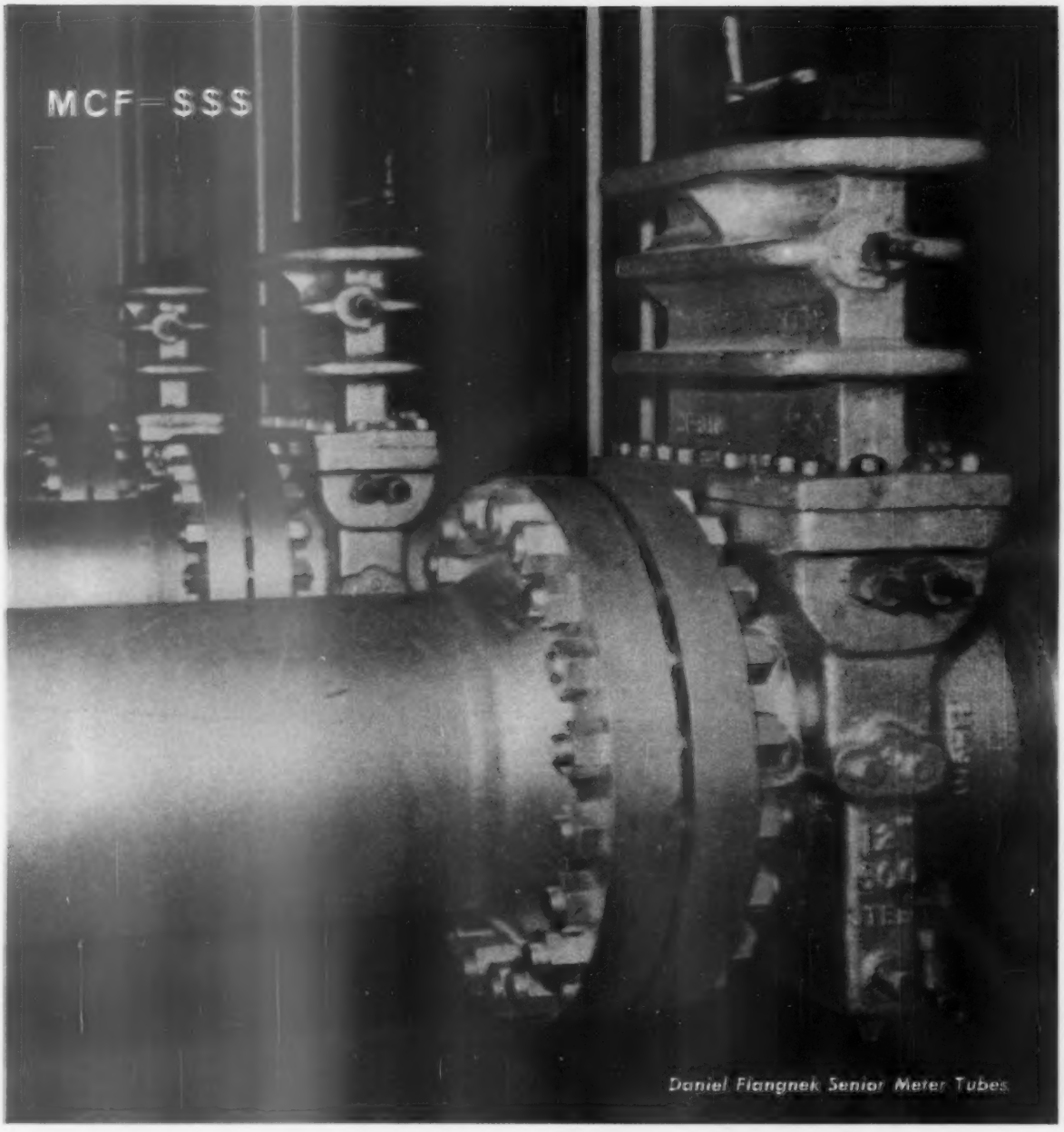
"Until world tensions lessen, the paramount call on our resources must continue to be for the protection of our freedom.... If undue preoccupation with the pursuit of comfort and convenience should blind us to this over-riding need, we could end up by having neither comfort nor freedom."

— Leo D. Welch, Chairman of the Board

Standard Oil Company (New Jersey)

(PRINCIPAL U.S. OPERATING AFFILIATE: HUMBLE OIL & REFINING COMPANY)



CASH REGISTERS

Natural gas changes hands in a hurry at the orifice meter station. Here is where millions of cubic feet become dollar signs. You expect optimum "cash register" accuracy and performance. You know you'll get just that with Daniel Orifice Fittings and Meter Tubes because they have the closest tolerances and are easiest to operate. Fast delivery, too. In all sizes (2"–36") and pressure ratings (125 lbs.-2500 lbs. ASA), you can depend on Daniel.

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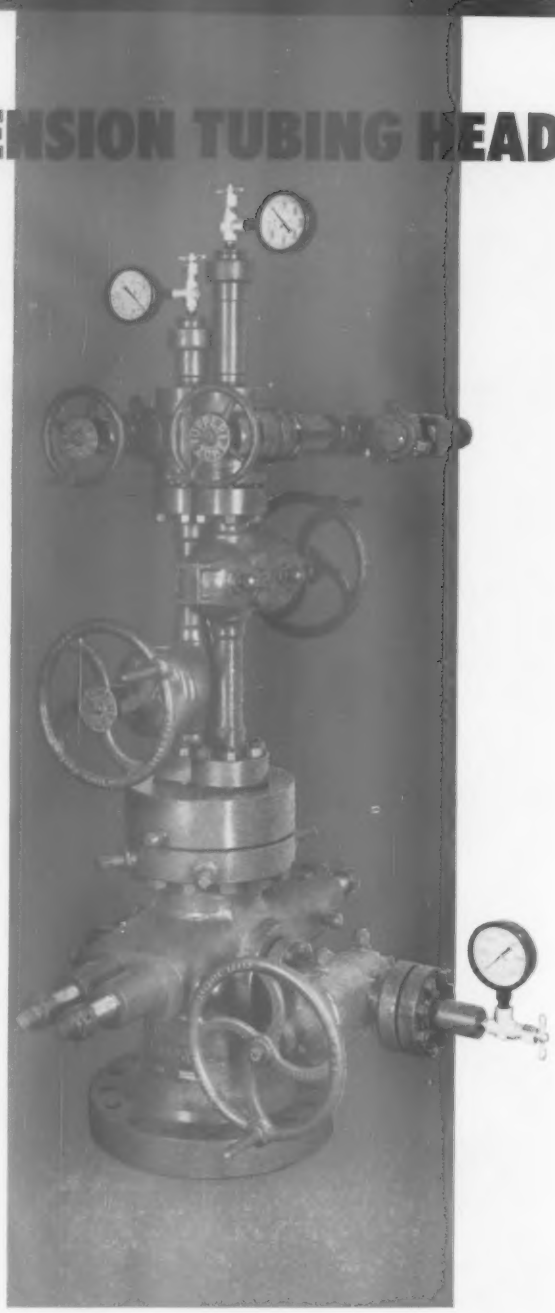
212

O·C·T DRT DUAL TENSION TUBING HEAD

Set and manipulate parallel strings in tension faster, safer



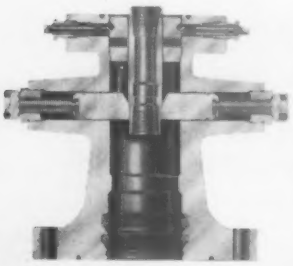
With this outstanding product of the Oil Center Tool Company, parallel strings of tubing can be set in controlled tension under blowout preventer control at all times. And flexibility, as in all O-C-T equipment, is an extra bonus. With the DRT, each string can be manipulated and set independently of the other.

Advantages of setting tubing in tension have been known for some time, particularly in the case of pumping wells where slack tubing strings result in high wear of rods and tubing. The advantages are even greater in the case of parallel tubing strings because of the much higher cost of workovers.

The O-C-T Dual Tension Tubing Head uses proved methods of sealing and supporting tubing. Action of both rams and sealing unit are direct and positive and both tubing strings may be run and set through blowout preventers with O-C-T Otis Back Pressure Valves installed. Annulus packoff is installed and activated before preventers are removed.

Available in full opening from 5½-inch to 7⅝-inch.

Contact the O-C-T representative nearest you for complete details about the DRT Dual Tension Tubing Head.



This cutaway drawing shows the independent supporting rams and seating element of the head. The packing around the tubing hangers is tightened by tightening hold-down screws.

O·C·T

OIL CENTER TOOL CO.

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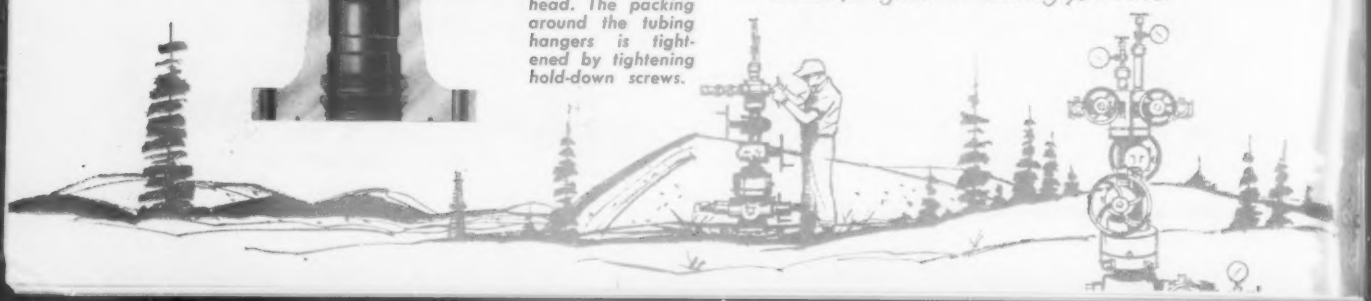
where progress is a daily practice



Improve your Engineering I.Q.*

* INCOME QUOTIENT

Train yourself and others in supervisory techniques for professional advancement

Popular thinking on any subject is often like a pendulum, swinging forward in sheer exhilaration over an exciting idea, then backward to a cynical attitude against it. Years ago, health columnists extolled the nutritive qualities of spinach. Shortly thereafter, it was equally popular to decry spinach as an overglamorized weed.

This vacillation springs from the efforts of spokesmen to capture interest, and the tendency of many people, like wild creatures in the forest, to give attention to whatever is moving regardless of the direction. That is why it sometimes seems that the more preposterous an idea the more credence it receives.

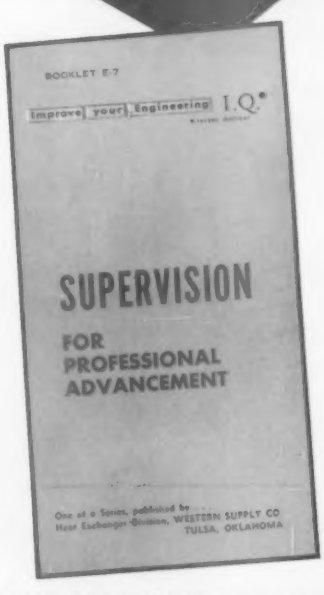
World War II, with its demands for hundreds of thousands of leaders to be developed quickly, accelerated the concept of training men in human relations. Many veterans tried, after the war, to apply the principles to industry. Supervisor and management development became extremely popular. Some of these programs naturally fell short of expectations, and there are always detractors — ready to display their intellectual brilliance by speaking cynically of *all* types of human relations training. Real progress in supervisory methods has, therefore, been slow.

Supervisory personnel, continually aware of the intrinsic values of human relations, are the key to uninterrupted production, completion of projects successfully and on time, for they forge the links in the productive chain solidly together.

Your management is interested not only in the creative, bold steps you would take into unknown solutions to problems, but also in how quickly and productively (profitably) you can put these ideas into practical application. When the solution, or idea, leaves your desk and starts down the long line of being put into practice, supervisors throughout that chain of action and their relationships with those about them — will determine to a great extent whether their individual components will function properly or whether a project will bog down under the weight of misunderstanding and apathy.

It signals to the engineer in charge, therefore, the importance of maintaining good supervisory practices throughout the various departments through which the original concept must be translated. It means a thorough understanding of human relations yourself, and the ability to communicate this understanding and appreciation to the supervisory personnel under you. This can and probably must be done both by individual contact with your supervisors and/or by conducting actual courses of study on the subject.

WRITE FOR YOUR COPY TODAY


BOOKLET E-7
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SUPERVISION
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. . . the foregoing paragraphs are a direct quotation from another of Western's personal-professional-development series, copies of which are available upon request at no charge. Western's conviction about the importance of competent supervisors as an adjunct to efficient engineering work is founded upon direct observation in our own plant, where trained supervisors contribute greatly to the manufacture of heat exchangers of the highest quality, and where personal attention to detail is their watchword. We invite your inquiry when heat transfer problems arise.

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CORRECTS AND COMPENSATES FOR VARIATIONS IN temperature — humidity — barometric pressures — dust.

Under any climatic extreme the all mechanical GRAVITOMETER measures specific gravity for use in orifice meter measurement. No *controlled* or *conditioned* atmosphere is required, and there are no complicated or critical adjustments to make for atmospheric variations.

The GRAVITOMETER was designed to eliminate errors in the float-type gravitometer when variations occur in the temperature and density of the atmosphere surrounding the sample float.

The GRAVITOMETER can be installed without the use of highly trained technicians, and is easily operated and maintained. Completely automatic, it produces positive, accurate and correct specific gravity measurements.

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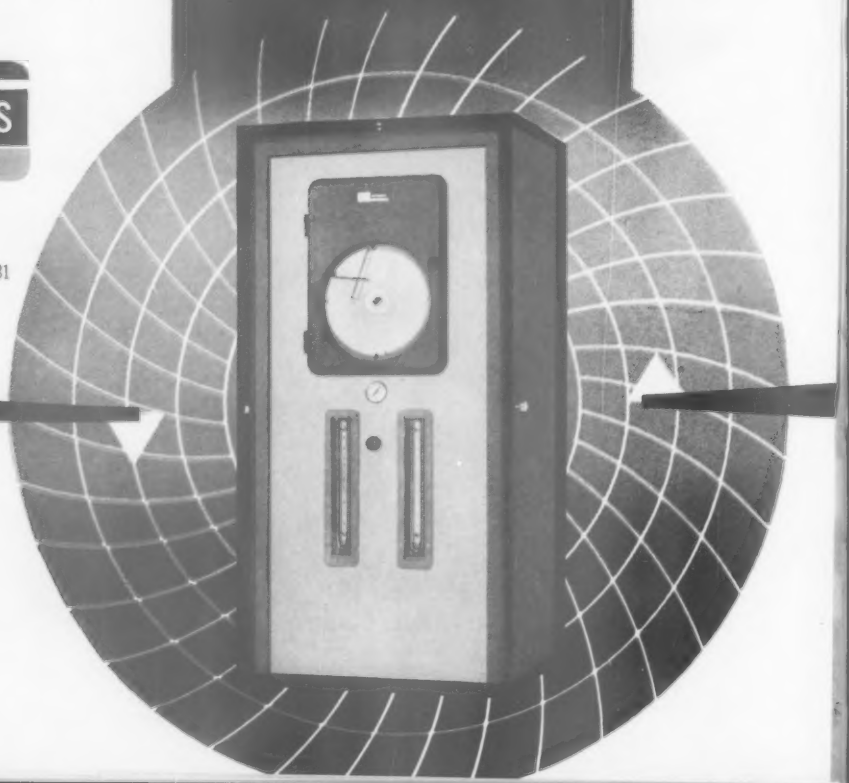

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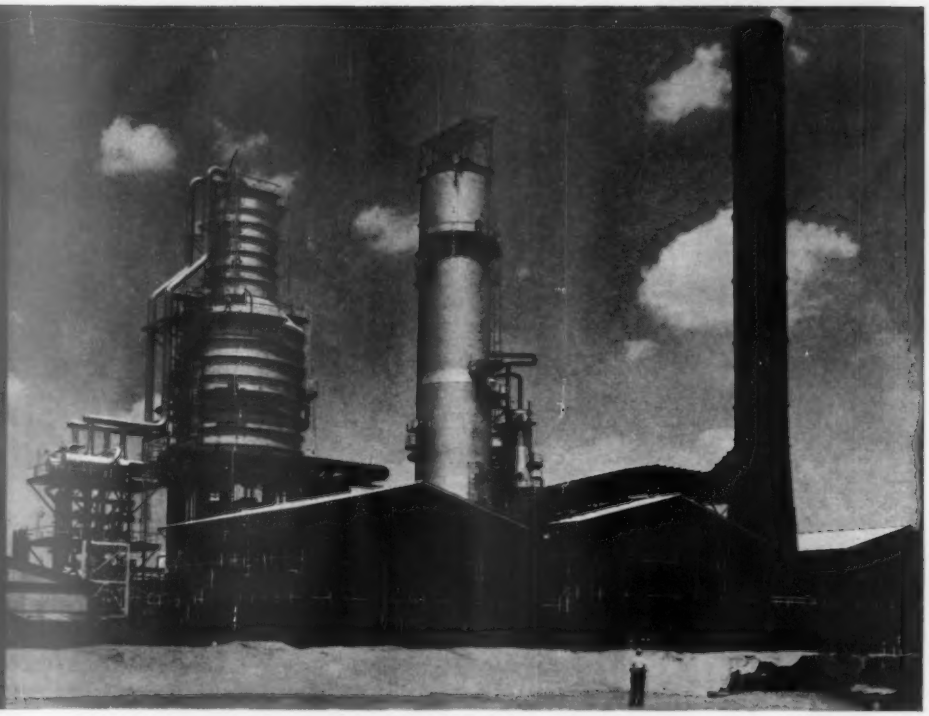
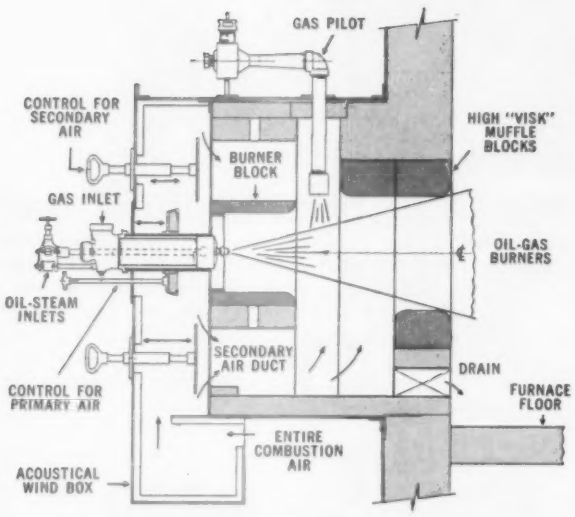
NATIONAL AIROIL TANDEM COMBUSTION UNITS . . .



Help Improve Performance of Nation's Largest Crude Still



R-9972

The nation's largest crude still—140,000 barrels per day rated capacity with ample reserve—is equipped with National Airoil improved Combination Oil and Gas Tandem Combustion Units . . . for *better* service and *improved* performance.

The oil fuel is high viscosity uncut vacuum tower bottoms, supplied to the burner at high temperature. The gas is refinery type at only medium pressure.

The burner design details emphasize a maximum of heat transfer by flame radiation with a high turn-down ratio.

Combustion noise has been minimized, on both primary and secondary air, by means of the acoustical wind-box which also serves as a "wind break."

Perhaps a National Airoil Combination Oil and Gas Tandem Combustion Unit can help improve performance at your installation. A discussion of your problem entails no obligation whatever. Write today.

NATIONAL AIROIL BURNER

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For stick electrode welding: choose from 36 Airco Stainless Electrode types. They give you high welding speed with low heat input. Welds are smooth, spatter is minimal, cleaning and polishing are easy.

For inert gas shielded processes: depending on application, you'll choose either AIRCOMATIC® gas shielded metal arc welding – or Airco's HELIWELD gas shielded tungsten arc welding. For both of these processes, Airco Stainless steel welding or filler wire gives excellent corrosion resistance and excellent tensile, ductility and impact properties.

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Fisher Series 4102 Gives

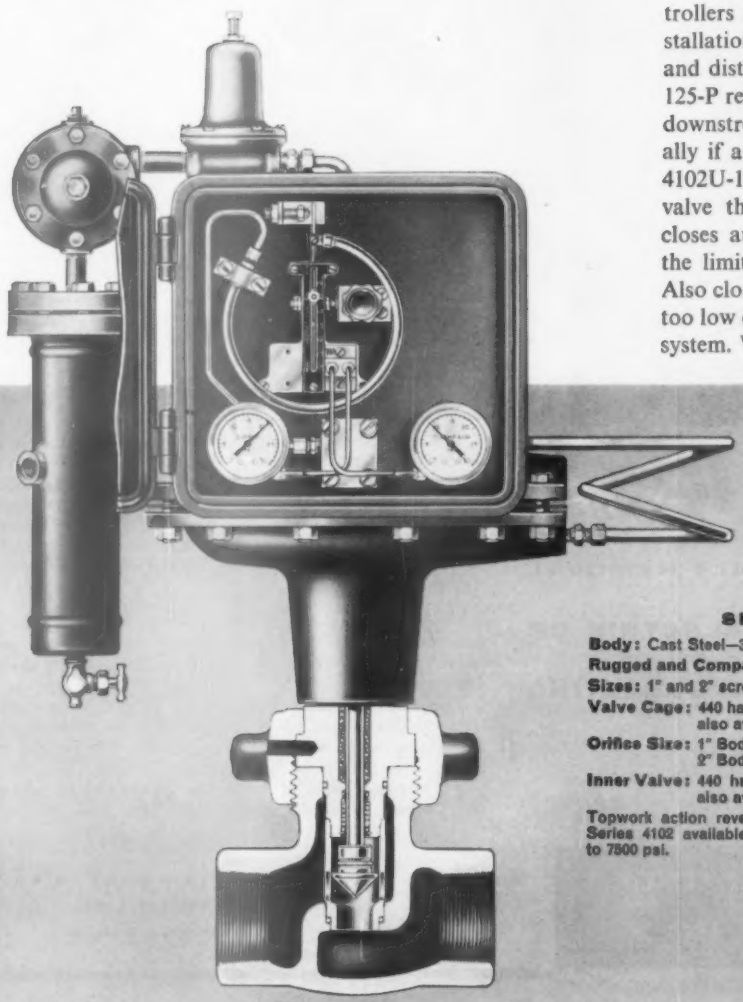
AUTOMATIC CUT-OUT

When the line pressure is too high

When the line pressure is too low

When a break in the line occurs

Here are the ideal hi-low cut-out controllers for well-head and flow lines installations and in natural gas transmission and distribution systems. Type 4102UR-125-P reduces or throttles pressure to the downstream system... closes automatically if a break in the line occurs. Type 4102U-125-P is a hi-low pressure safety valve that is normally wide open but closes automatically if pressure exceeds the limitations of downstream pressure. Also closes automatically if pressure falls too low due to a break in the downstream system. Write for Bulletin D-4102B.



SPECIFICATIONS

Body: Cast Steel—3000 psi WOG.
Rugged and Compact: Entire controller not over 2 feet high.
Sizes: 1" and 2" screwed angle or globe.
Valve Cage: 440 hardened St. Steel. (Tungsten carbide insert also available.)
Orifice Size: 1" Body—1/4", 3/8", 1/2", 3/4".
2" Body—1/4", 3/8", 1/2", 3/4", 1".
Inner Valve: 440 hardened St. Steel. (Tungsten carbide tip also available.)
Topwork action reversible in field with no additional parts. Series 4102 available with bronze or steel Bourdon tubes up to 7500 psi.

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD... CHANCES ARE IT'S CONTROLLED BY...

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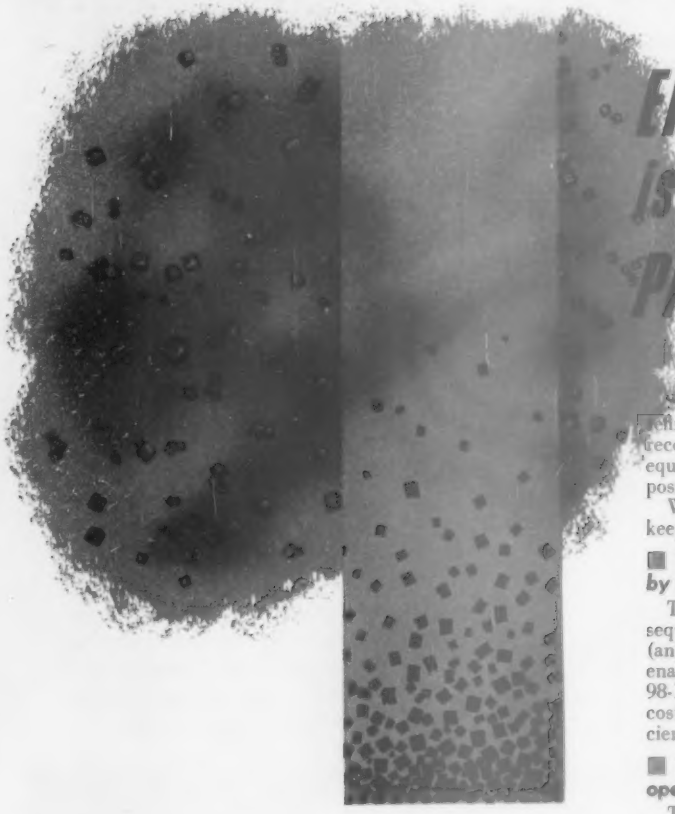
BUTTERFLY VALVE DIVISION:, CONTINENTAL EQUIPMENT CO., CORAOPOLIS, PENNSYLVANIA

FISHER® Controls

SINCE 1880

PRODUCT IMPROVEMENT WITH

PETRECO



EFFICIENT DESALTING is the first step toward PROFITABLE REFINING

Salt removal is now a routine operation in all modern refineries. With the need for effective desalting widely recognized, the main problem today is the selection of that equipment which will do the most efficient job at the least possible cost.

When you need new or additional desalting facilities, keep these points in mind:

■ ***The first electric desalter was designed and installed by Petreco engineers.***

This was nearly a quarter of a century ago. The subsequent years of solid, practical experience in dealing with (and solving) desalting problems all over the world now enable Petreco desalting to yield salt removals in the 98-100% range. The fraction of a cent per barrel desalting cost is saved many times over by the gains in refining efficiency resulting from a clean charging crude.

■ ***The first chemical desalter was designed and developed by Tretolite engineers.***

Tretolite chemical formulations were the first ever to be used in desalting. Tretolite desalting units are the only exclusively chemical desalters ever to be sold and installed in the refining industry and are currently used to desalt a million and a half barrels per day. In fact, every important development in crude oil desalting has resulted from the Petrolite research, engineering and development program.

YOU GET

98-100% SALT REMOVAL

WITH PETRECO ELECTRIC OR

TRETOLITE CHEMICAL DESALTING

Because Petreco offers both kinds of desalters, the company has no "axe to grind". This means that you get an honest and objective appraisal of the method best suited to your operation.

There is no other desalting equipment on the market today that can offer you comparable efficiency of design. The operating records from installations around the world *prove* it! There's no other company, either, that can offer you Petreco's fund of desalting technology or Petreco's rich background in this highly specialized field.

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The LimiTorque Valve Controls shown above are of the *Integral Control Type* (pioneered by LimiTorque). . . . *These self-contained "packaged units" offer integrally mounted NEMA rated reversing controllers, push-button and indicating light elements . . . The push-button elements, selector switches, etc. are all mounted inside the hinged cover for quick, easy accessibility.

LimiTorque "Integral Control" Valve Operators can save up to 50% over separate component equipment and installation costs—and, they are simple, foolproof and absolutely dependable. Send for LimiTorque Bulletin 10-A58, which completely describes and illustrates these new and exclusive Units.

There is no guess work or labor connected with LimiTorque Valve Controls—one man can open and close any type of valve, quickly and dependably in remote or hazardous locations.

LimiTorque may be actuated by any reliable power source, such as Electricity, Oil, Gas, Water or Air.

LimiTorque Operators can be field-mounted on existing valves . . . contact your valve manufacturer or nearest LimiTorque sales-engineering office.

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS
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runs, sets and drills faster than any other permanent packer"

HERE'S WHY!

Guiberson Type A Drillable Packer..

REDUCES PREMATURE SETTING Casing drag and junk impact are transmitted through the mandrel shoulder directly to tubing string.

REQUIRES ONLY ONE-HALF TUBING TRIP to set and place in production . . sets on wire line, too.

REQUIRES LESS SETTING FORCE Spring loaded lower slips are held drag-free from the casing until packer is set . . teeth remain sharp.

REQUIRES LESS DRILLING TO REMOVE Top slips are first part drilled. After drilling through them, packer can be fished out, or ½ to ⅔ of packer can be drilled and rest pushed to bottom of hole.

USES A SUPERIOR, OIL FIELD PROVED PACKING ELEMENT . . made in Guiberson plant.

FORMS A POSITIVE SEAL Unique internal mandrel shoulder expands packing element. All weight and high pressures are transmitted to packing element for a positive seal.

Compare Guiberson Drillable Packers for single or multiple-zone production . . acidizing . . pressuring operations . . water-flooding . . testing . . corrosion control . . many other completion jobs. Their speed and efficiency of setting and positive seal cut operating and replacement costs.

There's a Guiberson packer for every drillable packer application . . See your Guiberson man

TYPE A — With flapper valve and junk pusher

TYPE AN — No flapper valve.

TYPE AG — No flapper valve . . has guide body in place of junk pusher

TYPE AT — Has integral tail pipe connection . . no flapper valve

TYPE W — Small diameter . . wire line set only

TYPE AR — Small mandrel ID . . with flapper valve

TYPE ANR — Small mandrel ID . . no flapper valve

TYPE AGR — Small mandrel ID . . has guide body

TYPE A2R — Doubly restricted mandrel ID

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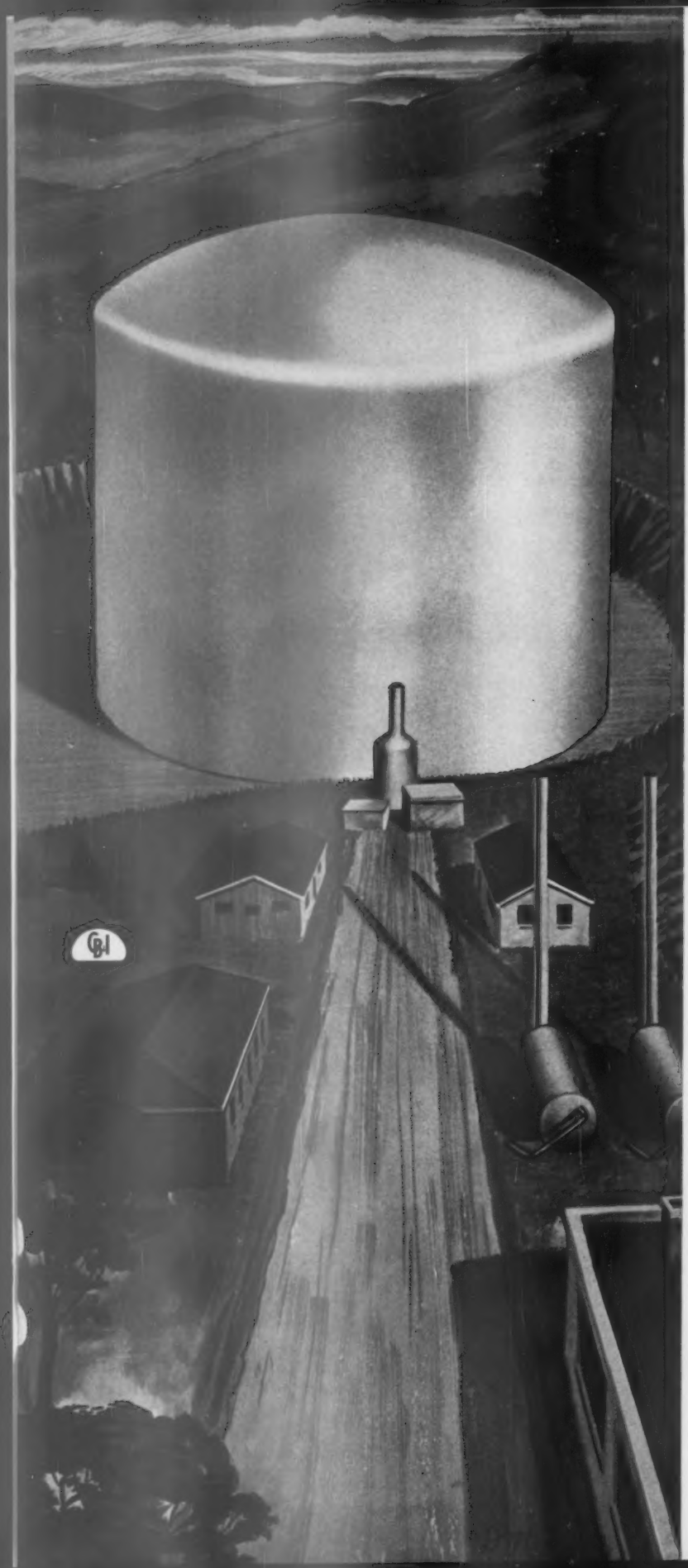

Unique Refrigerated **PROPANE** Storage System

WILL REDUCE COSTS OF DOUBLING PEAK SHAVING CAPACITY

A 120,000 bbl. propane storage tank will be the heart of a refrigerated facility for liquefied gas under construction at Minneapolis Gas Company.

The facility employs a unique approach in self refrigeration. Purging and control problems are reduced by condensation of vapors at less than ambient temperatures.

The double wall steel tank stores 120,000 bbls. at −50°F, the equivalent of 137,500 bbls. at +60°F. The outer tank will be 106 feet in diameter and 100 feet high.

Storing propane as a liquid for peak shaving is less costly than contracting for additional natural gas. The initial cost of conventional above-ground pressure storage would be about 3 times the cost of this refrigerated facility.

Fully refrigerated storage was selected for the new facility for (1) economy, (2) ease of expansion and (3) the ability to locate the facilities exactly where they would do the most good.

CB&I has complete responsibility for design, fabrication, erection and start up of the refrigeration plant and storage facility.

Write for our Brochure G-48, "Refrigerated Storage Facilities."

Another achievement in low-temperature storage

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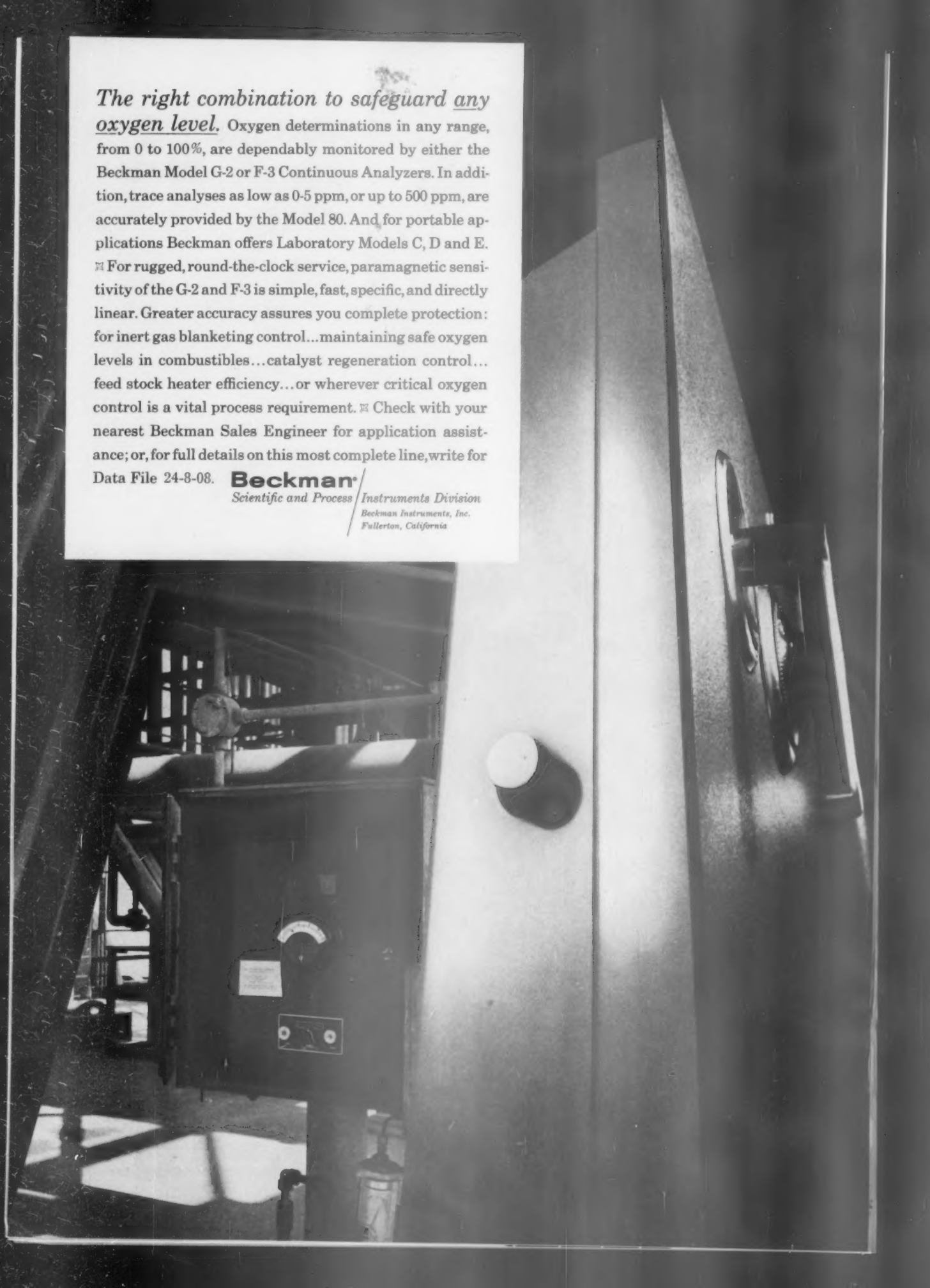

The right combination to safeguard any oxygen level. Oxygen determinations in any range, from 0 to 100%, are dependably monitored by either the Beckman Model G-2 or F-3 Continuous Analyzers. In addition, trace analyses as low as 0-5 ppm, or up to 500 ppm, are accurately provided by the Model 80. And for portable applications Beckman offers Laboratory Models C, D and E. ¤ For rugged, round-the-clock service, paramagnetic sensitivity of the G-2 and F-3 is simple, fast, specific, and directly linear. Greater accuracy assures you complete protection: for inert gas blanketing control...maintaining safe oxygen levels in combustibles...catalyst regeneration control... feed stock heater efficiency...or wherever critical oxygen control is a vital process requirement. ¤ Check with your nearest Beckman Sales Engineer for application assistance; or, for full details on this most complete line, write for Data File 24-8-08.

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Southwestern Lightwall has *earned* its reputation as the profit-pipe — earned it through greater savings in initial cost, transportation and handling, installation. The greater I.D. of Lightwall — compared to standard wall — means more flow-through, higher profits.

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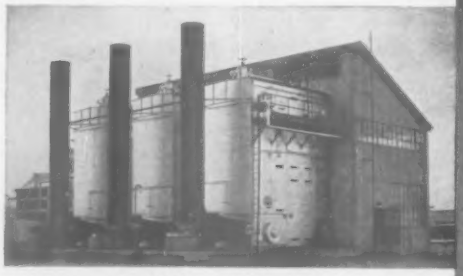
PROCESS EQUIPMENT FOR EVERY SERVICE

Vogt constructs process equipment in wide variety to all Codes. Stills and towers, oil chillers, crystallizers, heat exchangers, molding machines, etc., serve in the manufacture of oils, greases, 100 octane gasoline, synthetic rubber, chemicals and related products around the world.

MORE REFRIGERATION TONNAGE AT LESS COST

More than 70 years of engineering and manufacturing experience is incorporated in Vogt refrigerating and ice making equipment. Compression Systems and Tube-Ice Machines in a wide range of capacities serve industrial and processing plants and institutions here and abroad.



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Vogt steam generators are designed to give maximum rating in a minimum of space, with high efficiency and low maintenance expense. Bent tube and straight tube designs are available for solid, liquid or gaseous fuels to meet every power, process or heating requirement.

SPECIAL MATERIALS COMBAT CORROSION AND PRODUCT CONTAMINATION

Our modern shops produce a wide variety of equipment from special metals and alloys to fight corrosion and product discoloration or contamination. Fabrication procedures insure that corrosion resistant properties of welds will match that of the materials used to construct the equipment.

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. . . Cardwell Manufacturing Company, Inc., Wichita, introduced the first tractor-mounted hoist for servicing inaccessible oil wells in 1926. Since then Cardwell has become renowned for its fast-moving, hard-working equipment, the latest of which is

the HUSTLER

The Cardwell Hustler is a self-propelled unit designed for competitive servicing and workover in the 6,000 to 10,000 foot range. Available with a wide selection of Cardwell masts, the Hustler has a hook load capacity of up to 105,000 pounds. For maximum performance both on and off the highway, the Hustler features as standard equipment a Fuller 10-A-1120 Transmission which provides ten forward and two reverse speeds. The heavy-duty Fuller Transmission gives the operator a wide selection of line speeds and pulls best suited to the load being handled.

When it comes to mobility, this Fuller-geared unit really lives up to its name. It's one of the fastest servicing rigs ever developed—from the standpoint of mobility, rig-up and operating efficiency. And Cardwell gives a lot of the credit for the Hustler's hustle to its rugged Fuller 10-A-1120 Transmission.

Fuller Transmissions are designed to help you get more profit from *your* operation. For full details, see your truck or equipment dealer, or write Fuller Manufacturing Company.

FULLER TRANSMISSION DIVISION
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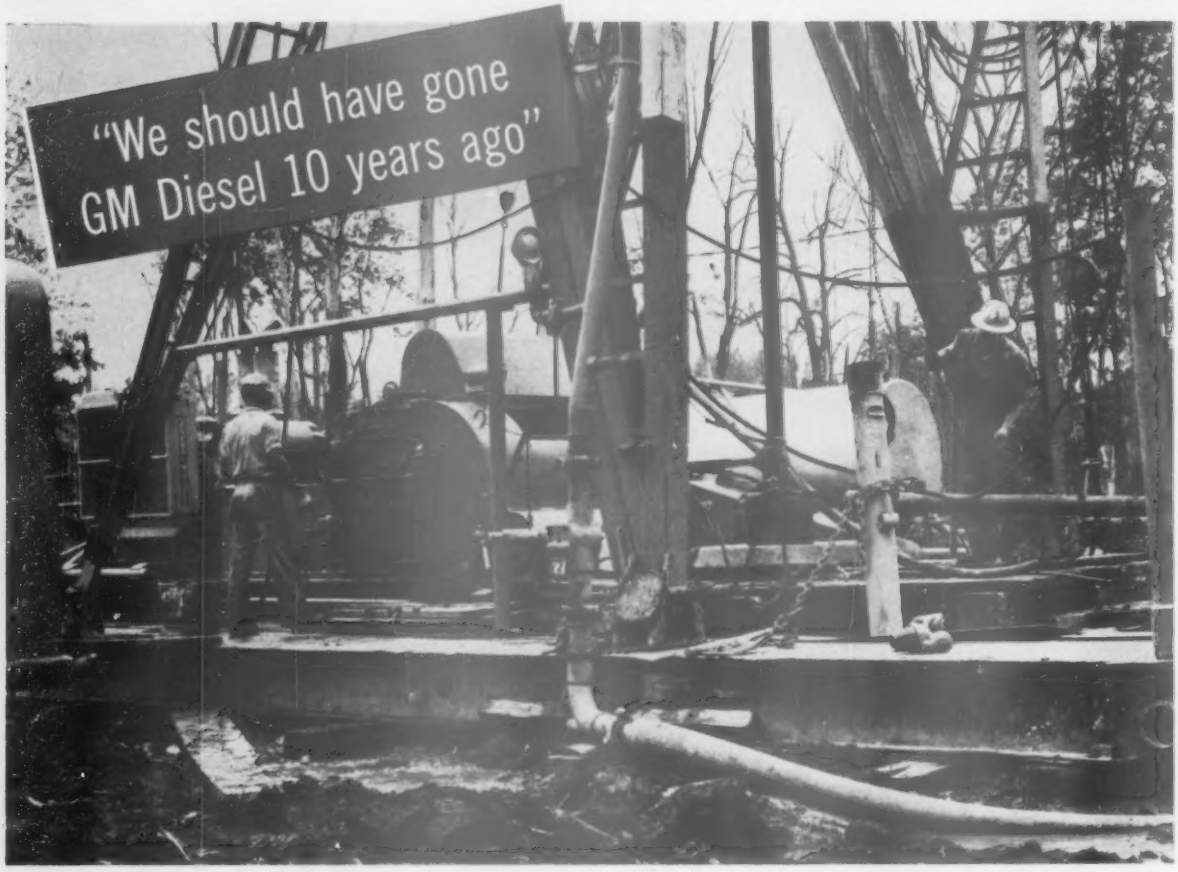


How do "Jimmy" Diesels rate with W. L. Johnson, partner in the Lohmann-Johnson Drilling Co., Inc., of Evansville, Ind. Here's what he says:

"These GM Diesel engines have given us a more dependable, trouble-free and economical operation than we previously thought possible with any type of power. We make hole faster through faster round trips and the prompt service offered by GM Diesel people wherever we operate. The compact size of 'Jimmy' Diesels has simplified our moving operations—reduced the number of trucks needed for moves. We should have gone GM Diesel 10 years ago."

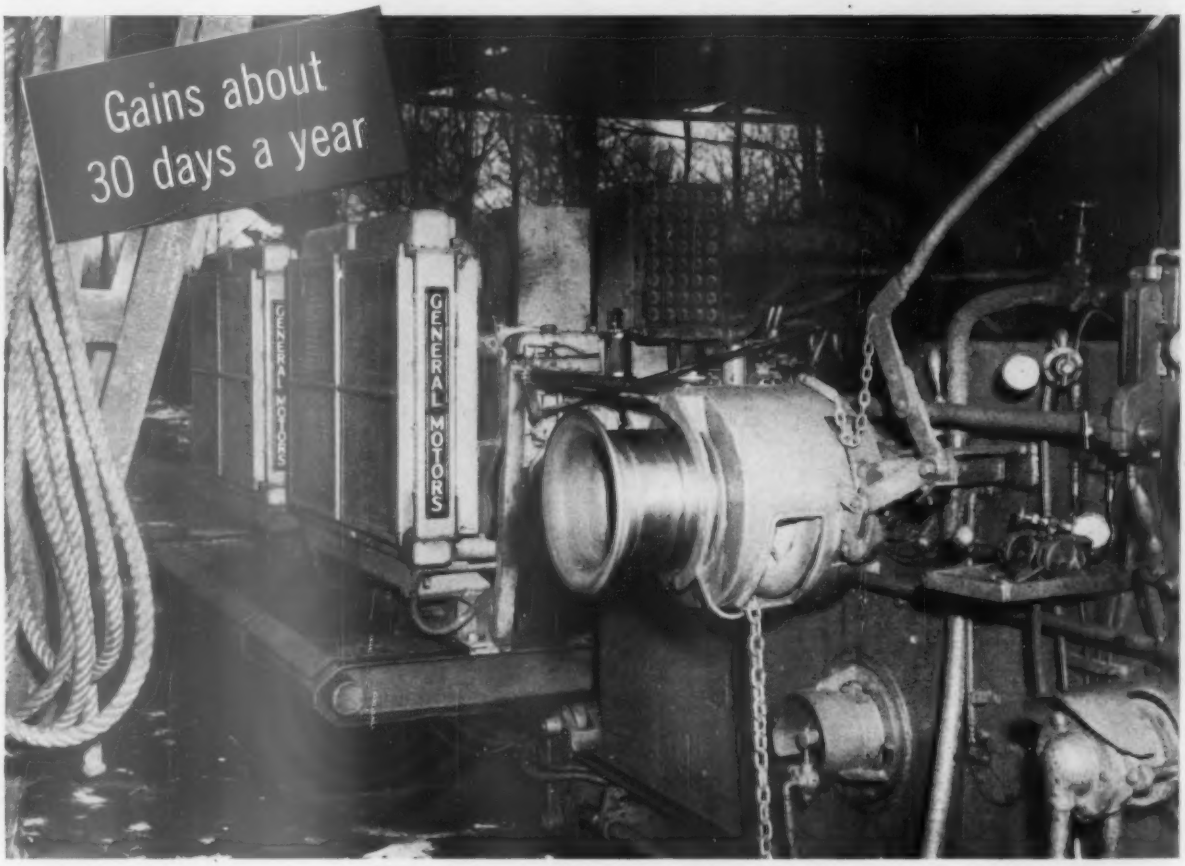
And Mr. Johnson's statement is based upon a lot of sound drilling experience. He talks the way he does because he's been using "Jimmys" since 1956, now has 14 rigs powered by GM 6-71 Twins.

Whatever you want in a Diesel—easy moves, quick acceleration, dependability, fuel economy—you'll get it from a "Jimmy." And you'll also get engines backed up by high-quality service and low-cost parts wherever your drilling takes you.

But get the whole story on GM Diesel power from your GM Diesel distributor. He's part of a coast-to-coast network of "engine people" you'll find in the Yellow Pages under "Engines, Diesel."

GM DIESEL ALL-PURPOSE

GET A GM DIESEL ENGINE



"They're right up on the governor 24 hours a day and, thanks to the better rate of penetration, we gain about 30 drilling days a year."

That's Sam Jack, Jr., vice-president of Pennsylvania's S.W. Jack Drilling Co., talking about the 36 GM Diesels that power his 9 drilling rigs operating throughout Pennsylvania and West Virginia.

He's drilling gas wells down to 7-8,000 feet . . . figures the time he gains because of the fast-working "Jimmys" puts him ahead "about one well a year."

Each of Jack's rigs has a pair of Twin 6-71 GM Diesels driving a Joy Compressor and a rotary. The compact size and low weight of the "Jimmys" let him rig-up quicker, give him faster moves, too.

This operator has been using GM Diesels for the past five years, runs 'em about 7,200 hours a year. And fuel for each engine on the rig costs about $1.00 per hour.

You could get the kind of productivity S.W. Jack gets if you had "Jimmy" Diesels working for you. Proof? See your GM Diesel distributor or write us for your copy of the brochure, "GM Diesel Oil Field Engines."

GM DIESEL

DETROIT DIESEL ENGINE DIVISION,
GENERAL MOTORS, DETROIT 28, MICH.

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Parts and Service Worldwide

POWER LINE

Sets the standard of Diesel productivity

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WJB and WJBF Series

JUNCTION CONDULETS®

NOW AVAILABLE IN 28 DIFFERENT SIZES...

Heavy-duty junction boxes have to be more than mere splice points. That's why the Crouse-Hinds WJBF floor-Condulet is built to resist wash-down water, atmospheric moisture, dust and alkaline atmospheres – conditions that will reduce an ordinary junction to fireworks long before the Fourth of July. Hot-dip galvanized, cast Feraloy construction does the job.

And you can get the same neoprene-gasketed moisture protection in the surface-mounted raintight Crouse-Hinds WJB Condulet. Both types are available in cast aluminum, sold at the same price as Feraloy.

28 sizes of each type are available, ranging from 4"x4"x4" to 24"x24"x12", with or without mounting feet. The number and size of conduit entrances can be specified or Condulets can be drilled and tapped in the field. *For more information check your Crouse-Hinds Distributor.*

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- Produced by newest, most modern equipment, combined with latest technology in forging, sizing, heat-treating and machining

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Formed from plate and welded—fully reinforced . . . same high quality as always

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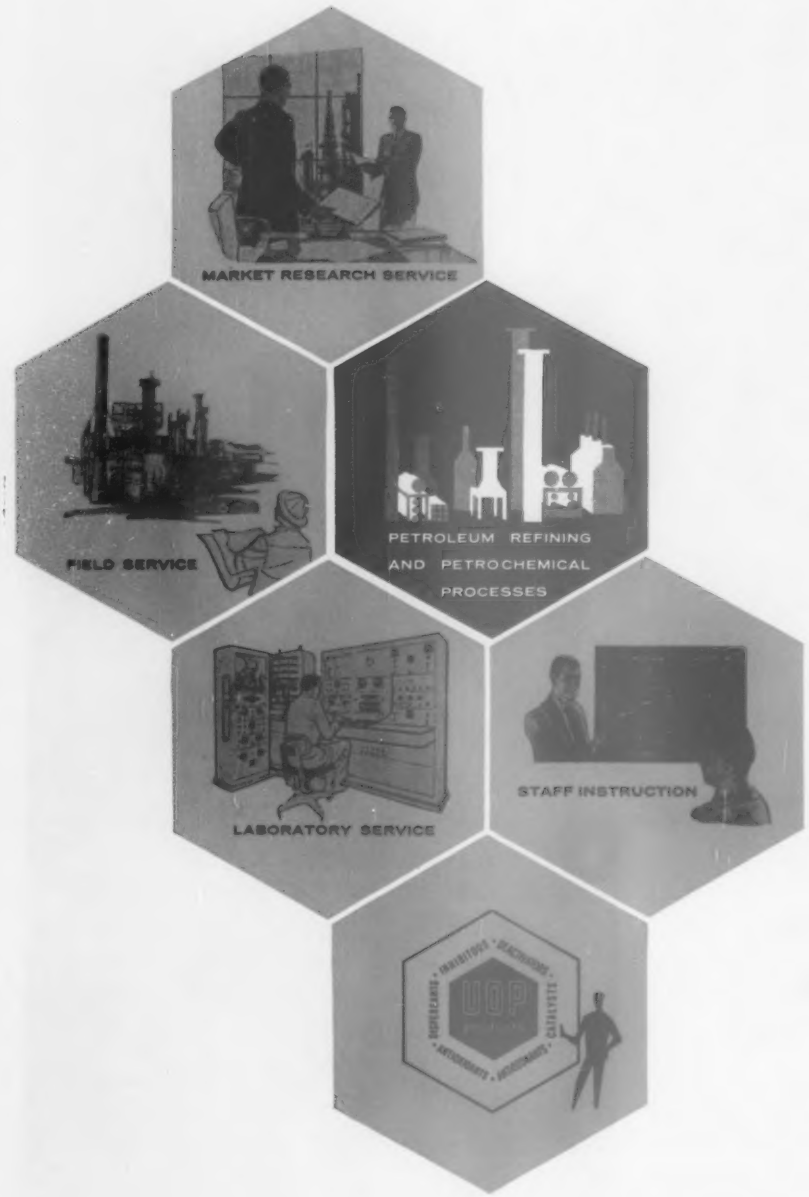
UOP PROCESSES, PRODUCTS AND SERVICES FOR THE PETROLEUM INDUSTRY



Shown here are the basic UOP activities serving the petroleum industry. UOP will be happy to provide more detailed information on any UOP process, service or product.

PETROLEUM REFINING AND PETROCHEMICAL PROCESSES . . . in all UOP offers 23 processes for the production of the full range of petroleum products.

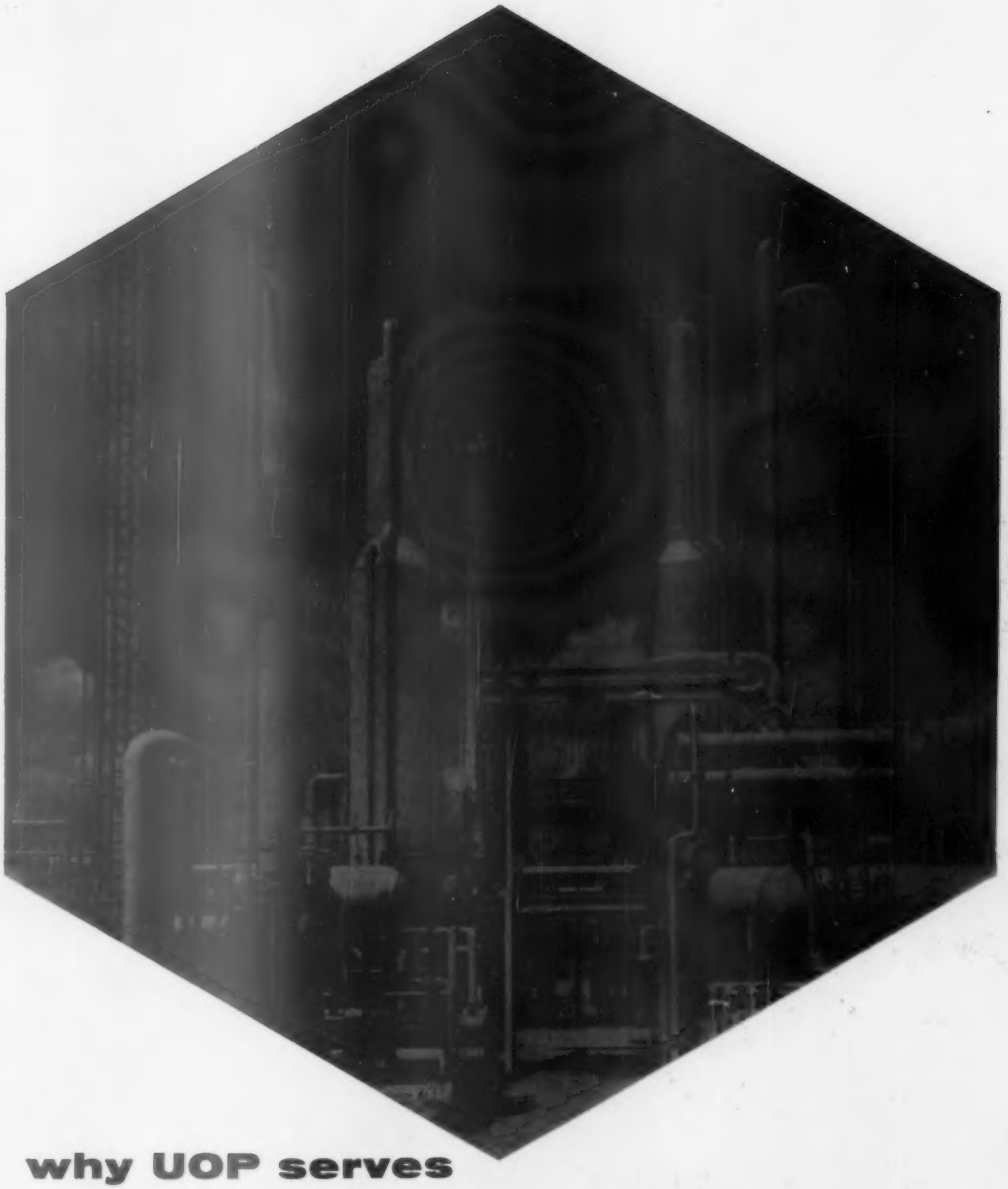
MARKET RESEARCH SERVICE . . . includes evaluation of markets and potentials, geographic factors, marketing trends, personnel requirements, and process application planning.

FIELD SERVICE . . . UOP maintains an experienced staff of refinery experts located in strategic areas of the free world. These specialists are available to handle processing and allied problems encountered by refiners.

LABORATORY SERVICE . . . Available to refiners, this service consists of crude evaluation, product stability analysis, gas concentration equipment performance, and allied problems in processing and product quality.

REFINERY STAFF INSTRUCTION . . . UOP provides expert staff instruction in training refiner's process operators in conjunction with the installation of UOP process units.

UOP PRODUCTS . . . UOP catalysts, developed and manufactured to exacting specifications of purity and high activity, assure efficient processing. In addition UOP offers a wide range of inhibitors and antioxidants for maintaining the quality of petroleum products. These additives enable refiners to solve such problems as product contamination, stability, color, viscosity, gum formation, and maintenance of octane values.



why UOP serves the petroleum industry so well

The fullest measure of service to the petroleum refining industry has been and will continue to be UOP's purpose. Starting with the research and design of petroleum refining and petrochemical processes, through the field and laboratory services performed in conjunction with these processes, UOP has directed its capacity to provide a wide variety of elements needed to aid the refiner in producing and marketing the best quality petroleum products.

Keeping refined products stable and maintaining product quality in transportation, storage, and use is an important area of UOP's aid to refiners. Over the years Universal has developed a wide range of petroleum inhibitors and additives to give refiners a reliable and economical means to safeguard the quality of their petroleum products.

Hundreds of refiners the world over are customers for UOP processes, services and products. Some use all . . . others use only certain specific processes, services or products. If you have a petroleum processing, marketing or product quality problem, talk it over first with UOP.

WHERE RESEARCH TODAY
MEANS PROGRESS TOMORROW

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TULSA NBT

National Bank of Tulsa is located in Tulsa, Oklahoma . . . the Oil Capital of the World. And in NBT's Oil Department banking men know oil as well as they know banking . . . because NBT continues to key its own progress to the healthy growth of the oil industry. Visit the Oil Department at National Bank of Tulsa . . . the Oil Bank of America.

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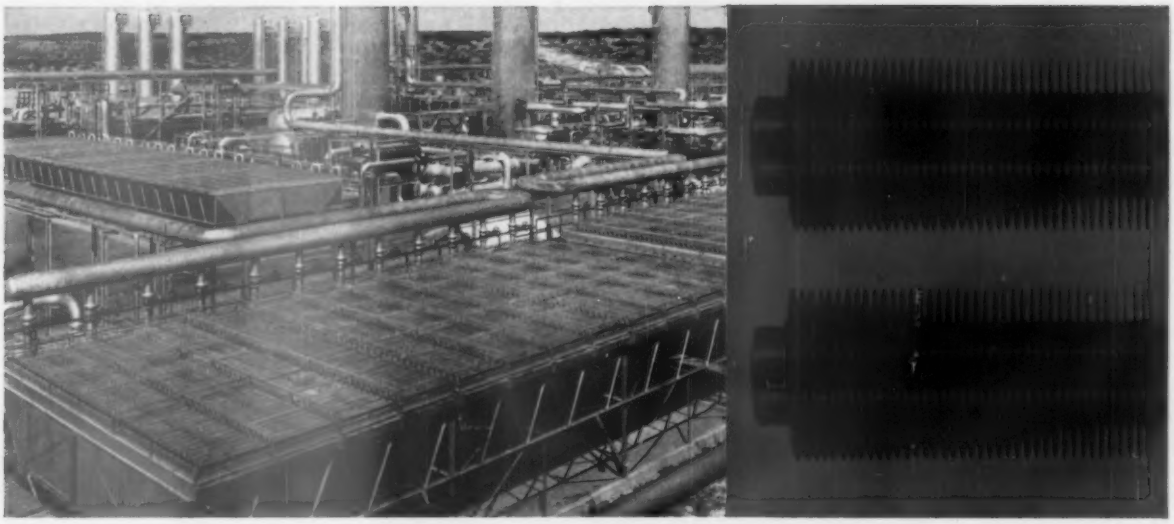
IT'S CHEAPER TO KILL HEAT WITH AIR



COMPARE TRANSAIRE . . . no matter what your water situation. Transaire air-cooled heat exchangers already have found wide acceptance in areas where water cooling is impractical or impossible. And now, finding that Transaire is less expensive to operate, even where water is plentiful, other areas are turning to this economical unit.

Simple in basic design, Transaire units are being used in many varied operations where low maintenance and low operating costs are important over extended periods of time. The high heat transfer efficiency is attained by use of the Yuba fintube. Its exclusive design employs tapered spiral fins mechanically bonded so that the entire base tube is covered and protected against the galvanic action that destroys efficiency in many other types of fintube. Both fins and base tubing can be provided in almost any material, size or gauge desired. Fin spacing and height can be varied to requirements. It's cheaper to kill heat with air – next time compare Transaire, a product of Yuba, pioneers in air-cooled heat exchangers.

Yuba also manufactures a complete line of shell and tube heat exchangers, and will recommend either type, whichever is required or best suited for the job.

YUBA

specialists in heat transfer equipment

YUBA HEAT TRANSFER DIVISION

YUBA CONSOLIDATED INDUSTRIES, INC.

Sales Offices in Chicago • Houston • Los Angeles • New York • Pittsburgh • San Francisco

CONTACTOR NUMBER 4

GLYCOL PROCESS AND DESIGN OPERATING INFORMATION

Proper use of glycols in well designed, correctly operated equipment is essential for efficient gas treating Some of these important design and operating considerations will be discussed in this series.

Dehydration with Glycols

Desiccant systems based on diethylene and triethylene glycol offer a number of economic advantages over solid dehydration units. For example, initial capital investment is less, desiccant make-up costs are lower, and operating expenditures are reduced by ⅓ to ½.

Since each operation should be considered as a special case, the following information about DEG and TEG is presented to help you determine the type of glycol best suited to your particular requirements.

Diethylene Glycol

Advantages:

1. It is stable in the presence of sulfur, oxygen and carbon at normal operating temperatures.
2. It is highly hygroscopic.
3. Carry-over losses are small.
4. It does not solidify in a concentrated solution.
5. It is non-corrosive.

Disadvantages:

1. Carry-over is greater than with TEG.
2. It cannot easily be regenerated to greater than 95% solution.
3. Dew point depression of 30-60° F. is less than with TEG. (Dew point depression is usually about 50° F.)

When oxygen and hydrogen sulfide are absent, reboiler temperatures may be raised to 330-350° F. to obtain higher concentrations of glycol and consequently greater dew point depression. Care should be exercised when using temperatures in excess of 325° F.

Triethylene Glycol

In *addition* to the advantages offered by DEG, triethylene glycol offers the following:

1. Higher dew point depressions of from 80 to 140° F. can be obtained if the TEG is dried sufficiently during regeneration.
2. TEG is easily regenerated to a 98-99.5% or higher solution in an atmosphere stripper because of its high boiling point.
3. It has a theoretical decomposition temperature of 404° F., while the temperature of DEG is 328° F.
4. Vapor pressure is 20% lower than DEG at 80° F. Thus, vaporization losses are lower.
5. Simpler regeneration equipment is required.
6. Dehydration is less expensive than with DEG — both in operating and capital costs.

Disadvantages:

1. The presence of light liquid hydrocarbons produce a tendency for foaming. The use of anti-foam agents is indicated to help control this condition.
2. Normally, it is not possible to obtain dew points as low as with solid desiccants.

In some instances, it may be possible for an operator to convert DEG units for use with triethylene glycol.

Operating Considerations

Gas temperature is a determining factor in the operation of liquid desiccant plants. Dew point depression as high as 96° F. has been obtained with TEG and 65° F. with DEG. If gas temperature is too high to give the desired water content in the dried gas, cooling should be considered. Since the initial cost of a TEG dehydration plant is generally less than half that of a dry desiccant plant, expenditure for cooling the gas is justified.

Methods of cooling fall into three basic categories: (1) Cooling by expanding the gas just ahead of the dehydrating unit . . . if pressure drop is available; (2) Use of various types of water coolers; and (3) Refrigeration. This may be accomplished by compressing the gas, removing the heat of compression and expanding, or by use of an external refrigeration unit.

In cases where an operator has an existing glycol dehydration plant which cannot meet newer, more rigid specifications for water content, consideration should be given to cooling the inlet gas or treating the gas from the glycol dehydrator in a small solid desiccant unit. These steps should be sufficient to place an existing glycol unit back into useful operation.

In cases where cooling does not provide sufficient water removal, a small solid desiccant unit may be used. This is practical, since much smaller units are needed than would be required for complete removal of water contained in the gas.

Cost of operating a glycol dehydration plant is approximately 20-60 cents per million standard cubic feet of gas. The economy of this system is apparent when one considers the cost of operating a dry desiccant plant, which is in the range of $0.60-$1.20 per million standard cubic feet of gas.

FOR MORE INFORMATION, look for future issues of Allied Chemical Contactor featuring articles on ethanolamines and glycols in gas treating operations.

We will gladly send technical data, delivery and price information on Allied Chemical Ethanolamines and Ethylene Glycols.

For specifications and local offices, see our insert in Chemical Materials Catalog, pages 475-482 and in Chemical Week Buyers Guide, pages 37-44.

BASIC TO AMERICA'S PROGRESS

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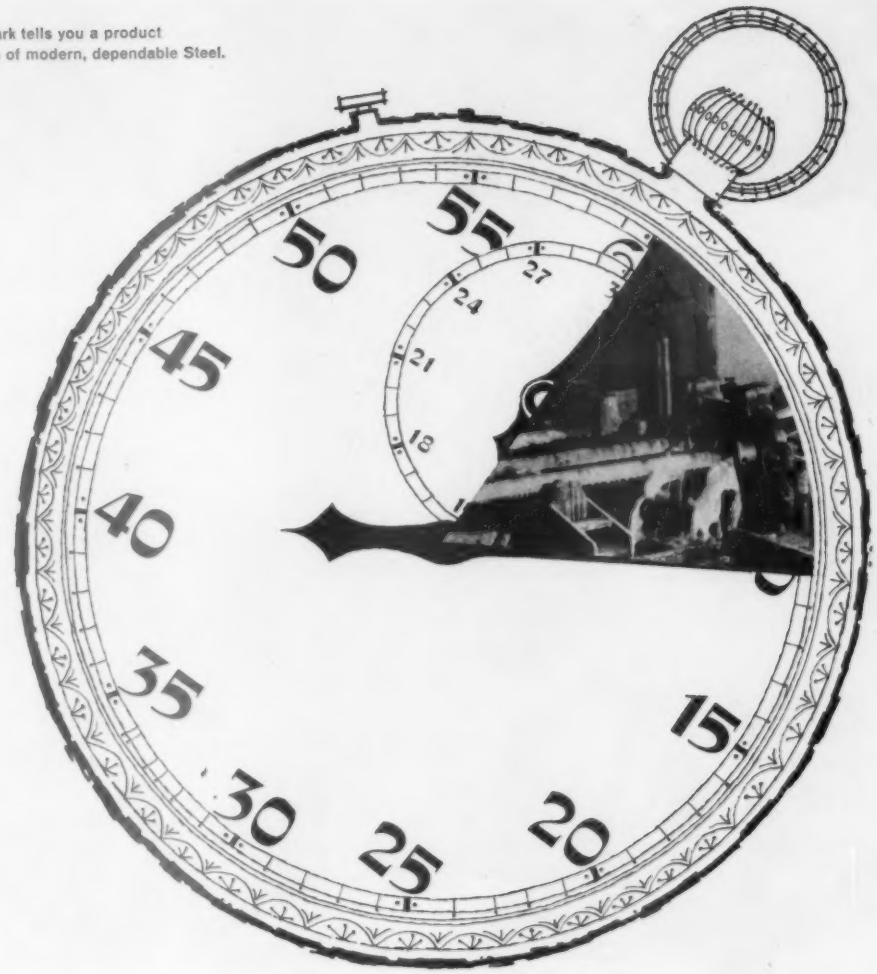
This mark tells you a product is made of modern, dependable Steel.



The ten most important seconds in the life of a pressure tube

Every length of USS National Electric-Resistance Welded Pressure Tube must pass a hydrostatic pressure test before it leaves our mill.

Each tube is fitted in leakproof heads and filled with water treated with a corrosion inhibitor. After all air is purged, pressure is applied and held for ten seconds. Internal hydrostatic pressure varies with size as prescribed by applicable ASTM specifications which are designed to produce a wall stress from 16,000 to 24,000 psi. Typical pressures so calculated are 4,000 psi for 1″ O.D. x .085″ wall and 2,100 psi for 3″ O.D. x .134″ wall.

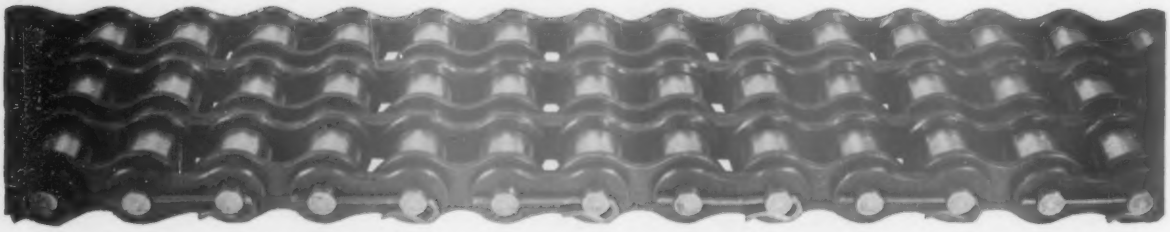
Our rigid inspection of each pressure tube promises long efficient service in boilers, heat exchangers, condensers, super-heaters, economizers and other pressure applications.

For your next installation, consider USS National Electric-Welded Pressure Tubes. They are stocked all over the country by National Tube Distributors. Our trained Mill Service Force is also available for field consultation. Write National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

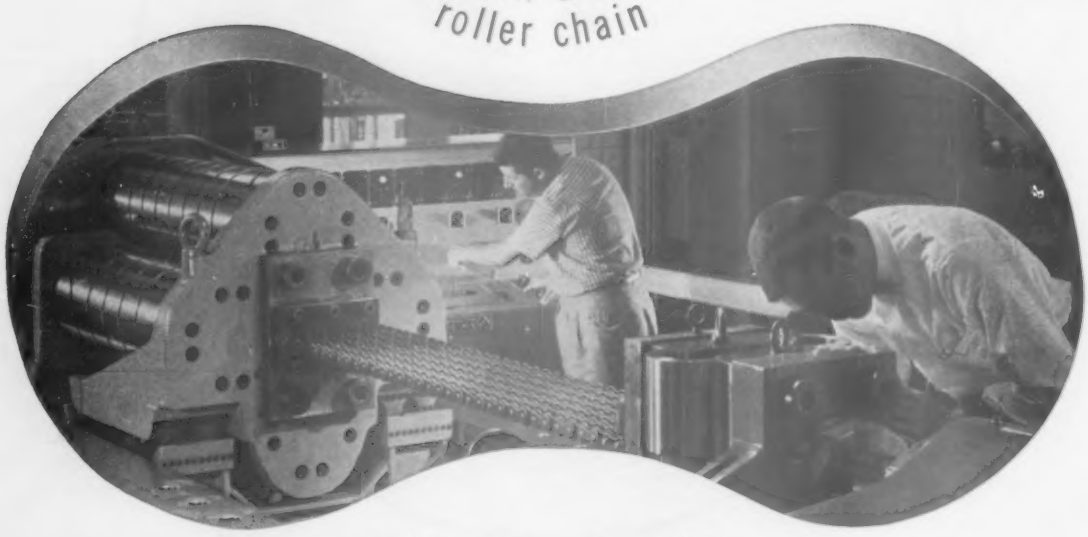
USS and National are registered trademarks

National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Supply Division • United States Steel Export Company, New York



Another of the invisible extras that insure MORE ON-BOTTOM TIME with LINK-BELT FR® roller chain



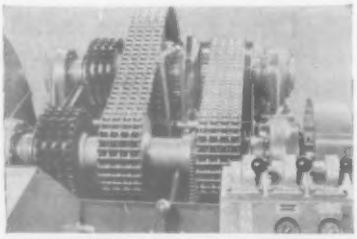
Cyclic-tension test verifies

top fatigue strength

Fatigue Resistant FR* processing of sidebars lengthens the life-span of Link-Belt roller chain. FR increases chain's endurance limit by compressing the metal around pitch holes . . . the critical sidebar areas most vulnerable to fatigue failure.

On the test equipment above—the industry's largest and fastest fatigue machine—Link-Belt has proved conclusively the superior fatigue resistance imparted to roller chain by the FR process. The machine produces up to 65 tons of cyclic tension. Rapid "stress-on, stress-off" action duplicates toughest conditions of rig operation.

From such facilities for research, production and quality control—plus extensive field testing—Link-Belt roller chain inherits invisible extras that withstand the grueling tensions of drilling service.



NATIONAL DUAL-ENGINE INDEPENDENT PUMP DRIVE incorporates quadruple-width Link-Belt Precision Steel roller chain with FR.

For engineering assistance in applying FR roller chain, write Link-Belt Company, Indianapolis 6, Indiana. Ask any leading supply store for our Catalog 2980 containing full information on roller chain and other oil field equipment.

U.S. Patent No. 2,517,497

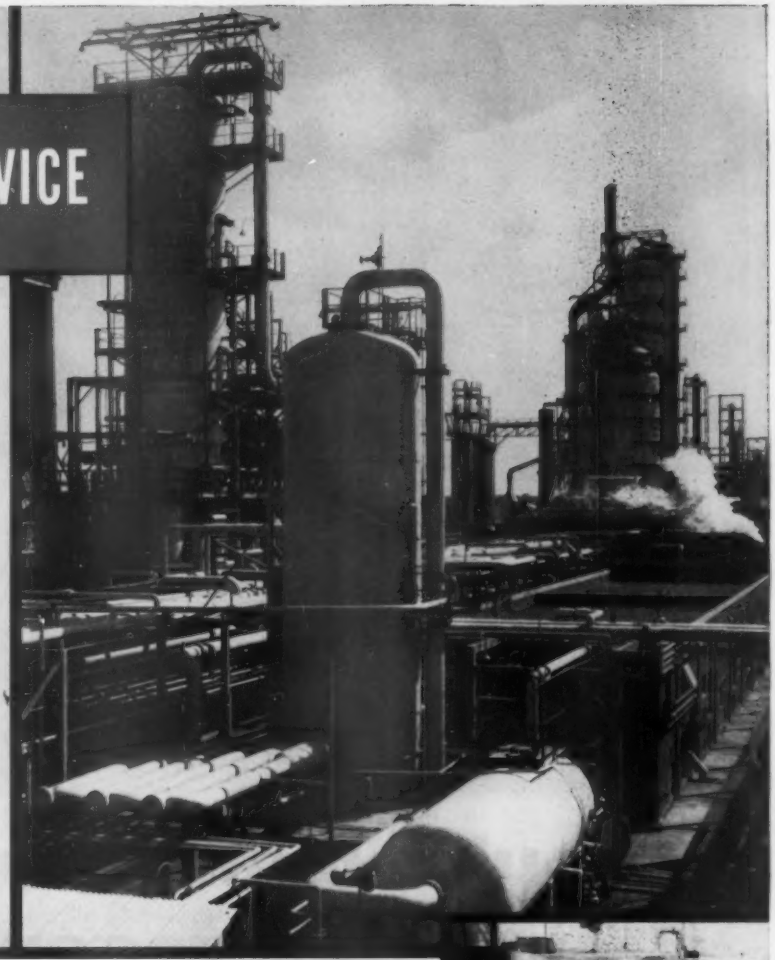
LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 15,570

LINK-BELT

ROLLER CHAINS AND SPROCKETS

another
TRETOLITE SERVICE
report

KONTOL
Corrosion Inhibitor permits low pH operation in refinery's crude unit overhead system



OHIO OIL COMPANY GETS EFFECTIVE CORROSION CONTROL, BETTER PRODUCT QUALITY AT REDUCED COST

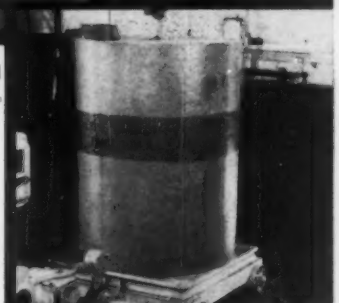
An outstanding performance record compiled over a five-year period in Ohio's refinery at Robinson, Illinois, proves the feasibility of low pH operation augmented by KONTOL* Corrosion Inhibitors.

Prior to inauguration of the low pH-KONTOL program, a high (7.5) pH operation on overhead receiver waters was fouling equipment. Heavy sludge deposits were accumulating ahead of exchanger baffles, and ammonia was contaminating hydrocarbon streams. These troubles limited the refinery to short runs at decreased capacity. *In addition, serious corrosion problems resulted in extensive equipment replacement and repairs after only nine months of operation.*

By changing to a low (4.0-4.5) pH and injecting KONTOL Corrosion Inhibitor at a rate of 10-15 ppm, Ohio has stopped sludging and greatly lowered ammonia contamination. Equipment has been kept clean, reducing maintenance costs and permitting longer runs at increased charge rates. Turnaround inspection has been lengthened to 18-month intervals. *No equipment failures due to corrosion occurred during this five-year period.*

Low pH operation supported by KONTOL corrosion control might offer important advantages for your refining facilities. Ask the Man in the Red Car to explain this program, or write . . .

*Registered trademark, Petrolite Corporation



Facilities such as this one for Kontol injection at various points are part of over-all corrosion control program at Ohio Oil Company's Robinson, Ill., refinery.

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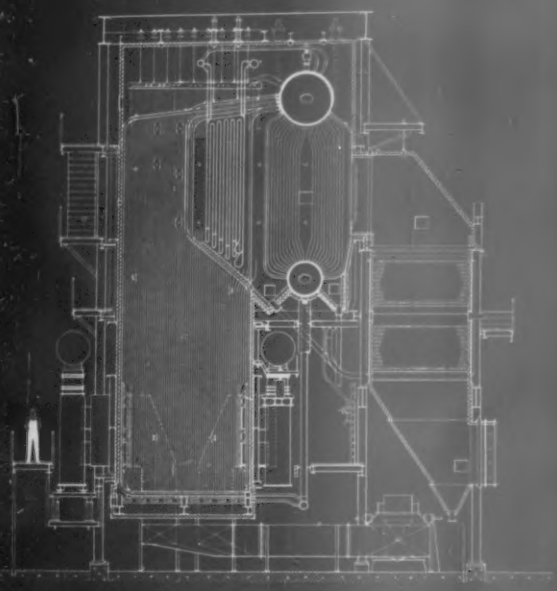
KR-60-1

This unit delivers 175,000 lb of 750F steam per hour at 650 psig. In addition to CO gas, it burns pitch, refinery gas and Bunker C oil.



One of two CO boilers for a Texas refinery. Oxygen for combustion is supplied by the exhaust from the gas turbines which drive the regenerator compressors. Steam conditions are 177,000 lb per hr, 625 psig and 700F.

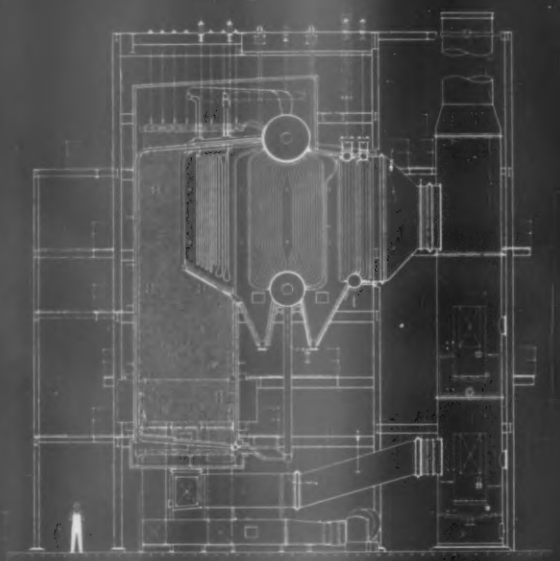
If you're looking for the best catalyst regenerator gas

Here are 8 reasons why

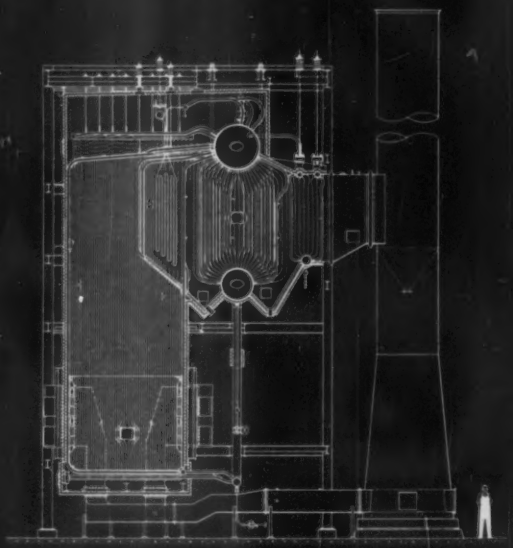
1. **YOU'LL WANT HIGH AVAILABILITY**
   And the records show that the first CO Boiler placed in service by C-E has been on the line for more than two years without a single unscheduled boiler outage.
2. **YOU'LL WANT OPTIMUM RETURN**
   And CO Boilers by C-E burn regenerator gas efficiently *from minimum to maximum loads.*
3. **YOU'LL WANT LOW POWER CONSUMPTION**
   And CO Boilers by C-E provide minimum air pressure loss and minimum fan horsepower requirements.
4. **YOU'LL WANT LOW MAINTENANCE**
   And double steel, skin cased CO Boilers by C-E contain a minimum of exposed refractory.
5. **YOU'LL WANT THE MOST EFFECTIVE USE OF MATERIALS**
   And C-E makes optimum use of boiler and superheater – gas passage areas and heating surfaces are uniformly distributed across the width of the unit.
6. **YOU'LL WANT ADVANCED DESIGN**
   And C-E Tangential Burners provide complete and positive mixing of air, auxiliary fuel and CO gas, preparing the combination for instantaneous ignition on injection in the furnace.
7. **YOU'LL WANT MAXIMUM CONTROL OF THE COMBUSTION PROCESS**
   And CO Boilers by C-E offer individual, shielded cut-off dampers for each CO gas burner and individual air control for every burner.
8. **YOU'LL WANT A PRODUCT THAT HAS PROVEN ITSELF**
   In terms of general experience, a total of more than 675 tangentially fired C-E boilers have been purchased to date for use with various fuels. As to specific experience with lean fuels, C-E – in addition to its CO Boiler installations in refineries – has installed more than 150 boilers burning blast furnace gas . . . a fuel similar to CO gas with a heating value of about 80 Btu per cubic foot.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

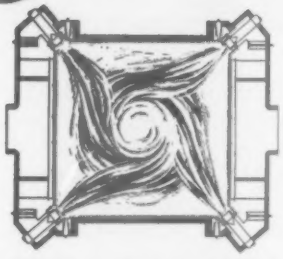
This unit is designed to produce 85,000 lb of 750F steam per hour at 625 psig. Note the C-E seal tank arrangement in the bottom-supported stack.



In its third year of service, this unit provides 100,000 lb of 550F steam per hour at a pressure of 250 psig. It has been off the line only when the cat cracker was removed from service for scheduled maintenance.

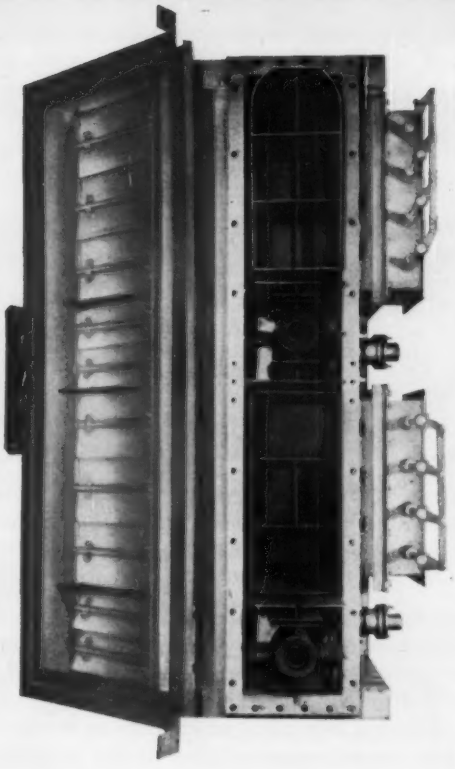


boiler to burn See C-E



Plan view diagram showing principle of tangential firing in a completely water-cooled furnace.

The C-E Tangential Burner for CO gas. Zone controlled, dampered air inlets are shown at left, dampered CO gas inlets at right. The center panel is a furnace view of the burner The oil burners in the cen ter and bottom compartments are flanked by flat head burners for natural or refinery gas firing. CO gas is admitted through the other ports.



COMBUSTION ENGINEERING

C-E

C-148

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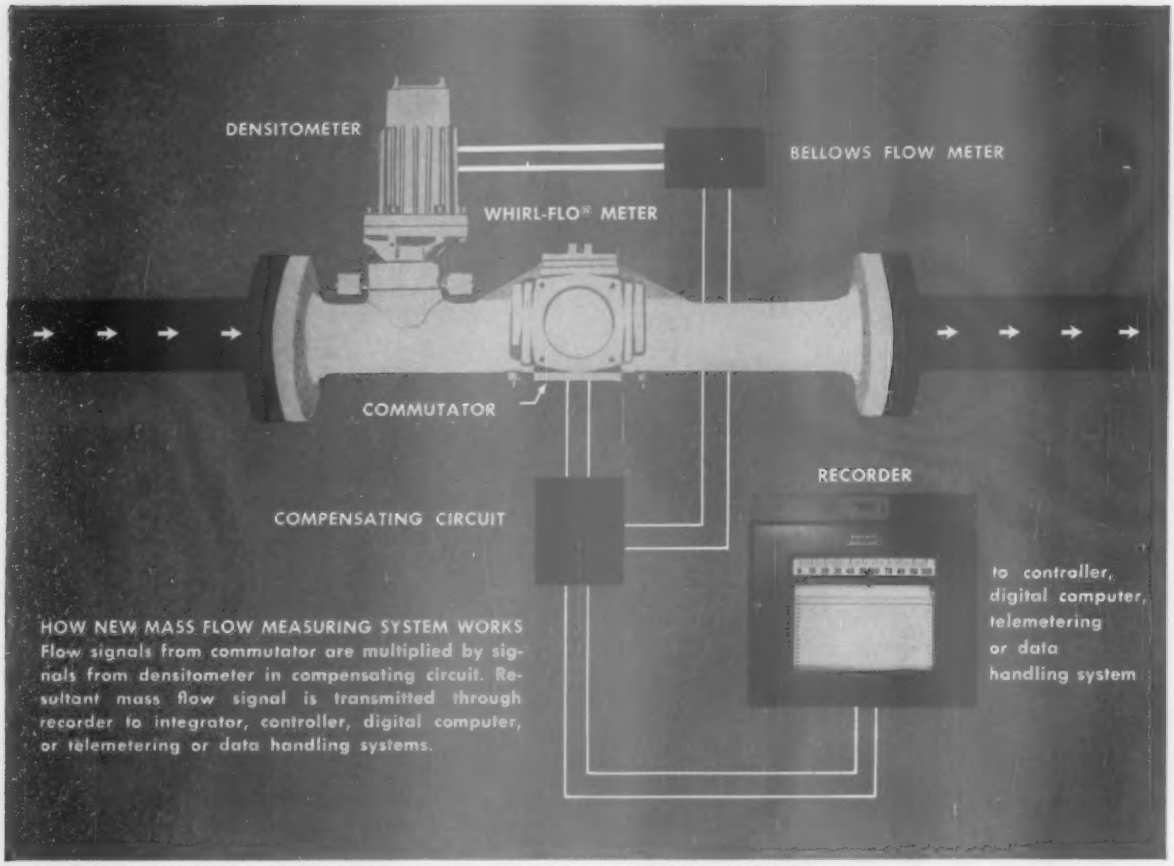
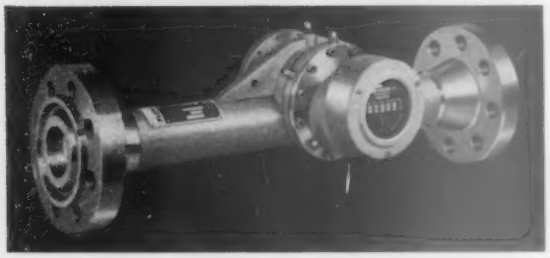

DENSITOMETER
BELLOWS FLOW METER
WHIRL-FLO® METER
COMMUTATOR
RECORDER
COMPENSATING CIRCUIT
to controller, digital computer, telemetering or data handling system
HOW NEW MASS FLOW MEASURING SYSTEM WORKS
Flow signals from commutator are multiplied by signals from densitometer in compensating circuit. Resultant mass flow signal is transmitted through recorder to integrator, controller, digital computer, or telemetering or data handling systems.

NEW HONEYWELL MASS FLOW MEASURING SYSTEM

meters liquids and gases with accuracy of ±½%



Here's the system that delivers *accurate, automatic, and continuous mass flow measurements* of liquids and gases for the most demanding process control, accounting, and custody transfer applications.

By using the highly accurate Whirl-Flo® Meter as the primary element, Honeywell makes available a fully compensated mass flow measuring system that delivers linear accuracies of ±½% under most operating conditions regardless of changes in temperature, pressure, or compressibility of the liquids or gases being metered. All the primary and compensating elements are built right into the system.

You get a mass flow measuring system that's custom made to suit your specific application.

This new mass flow system can be linked easily to telemetering and remote control systems, data handling, and process computers . . . can meter a wide variety of fluids—water, air, propane, butane, natural gas, gasoline, no. 2 fuel oil, ammonia, ethylene, and even some slurries. The flow meter body itself is available in standard sizes from 2 to 16 inches.

Get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone. MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa. In Canada, Honeywell Controls, Ltd., Toronto 17.

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Take those pumps and rigs in the oil fields—or those tanks and pipelines in the refineries! Each needs the tough, colorful, lasting beauty that Rust-Oleum provides. If the surface is rusty, Rust-Oleum 769 Damp-Proof Red Primer can be applied *right over the sound rusted surface* after removing rust scale and loose rust. Special Rust-Oleum Oil Field Finishes match the original equipment colors on pumps and rigs — while other long-lasting Rust-Oleum coatings protect costly tanks and pipe lines.

They're specially made for oil field use — tough, flexible, easy-to-use on the spot by brush or spray! They dry to firm, glossy finishes that resist sun, fumes, heat, moisture, weathering, and blowing dust and sand.

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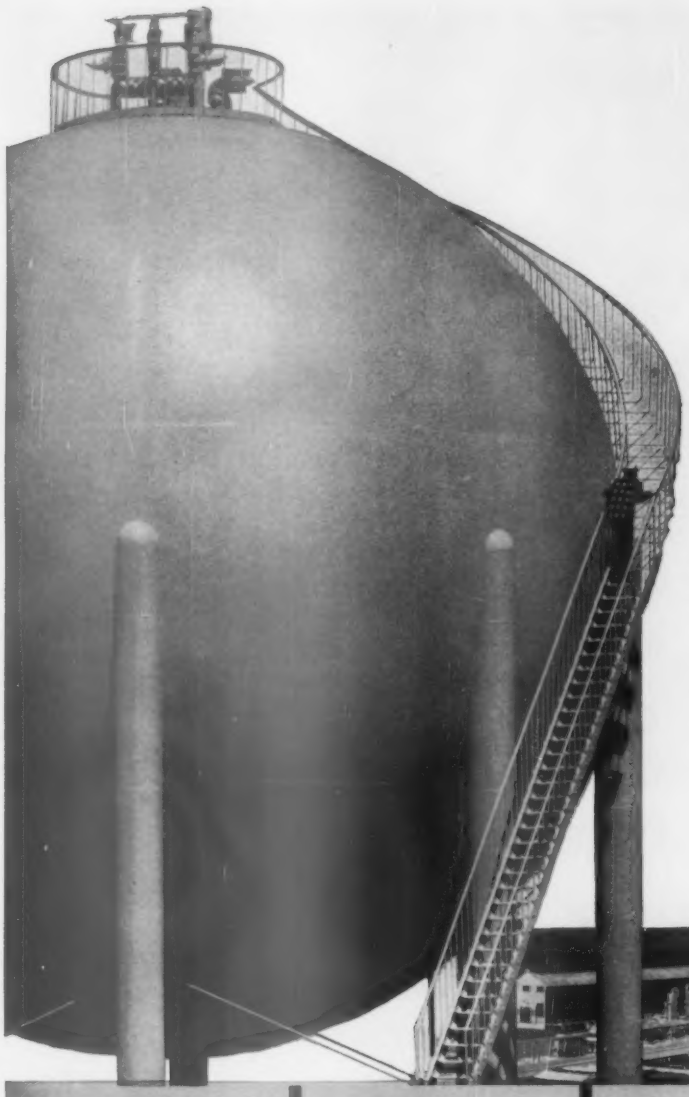

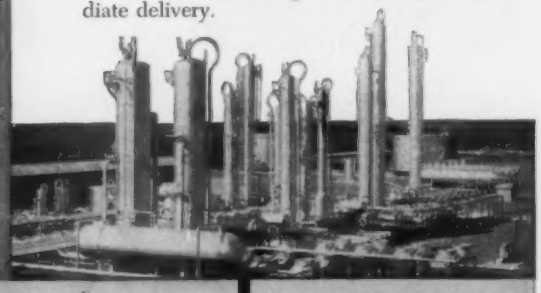

Apply Rust-Oleum 769 Damp-Proof Red Primer directly over sound rusted surfaces.

Follow-up with the Rust-Oleum finish coating in the color of your choice

By brush or spray — the Rust-Oleum system provides tough, colorful, lasting beauty.

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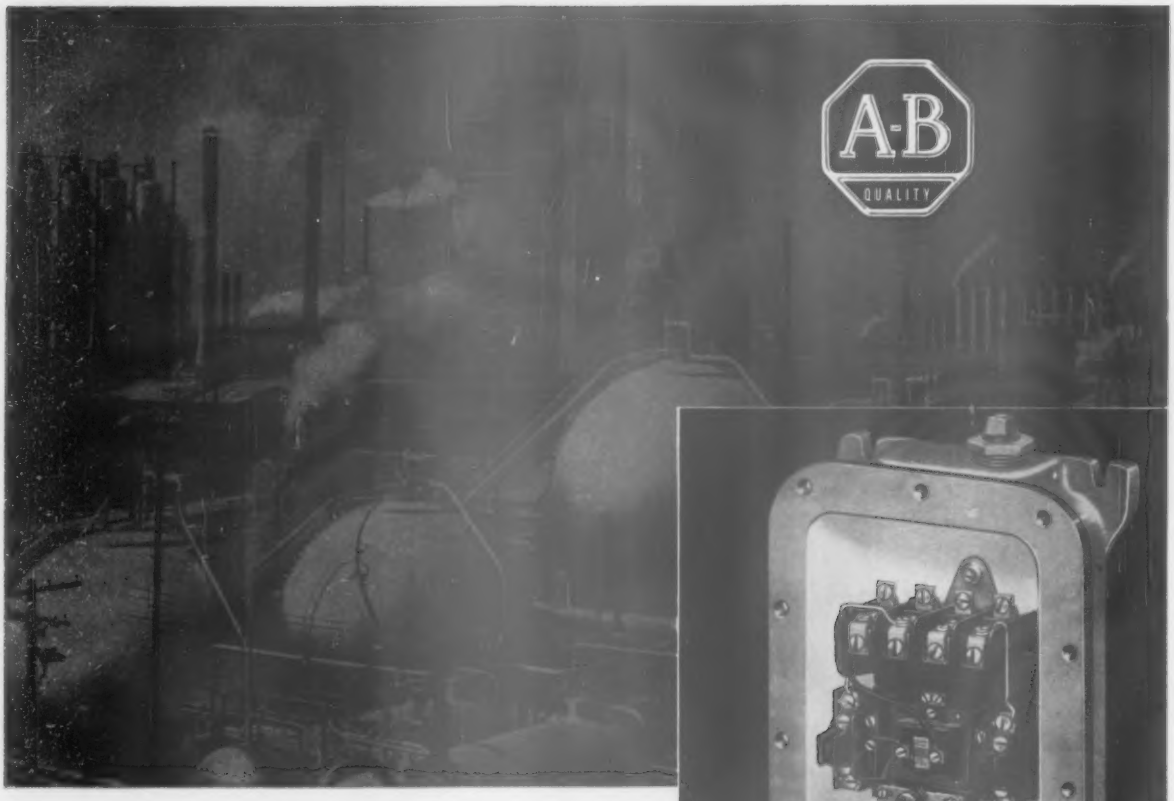

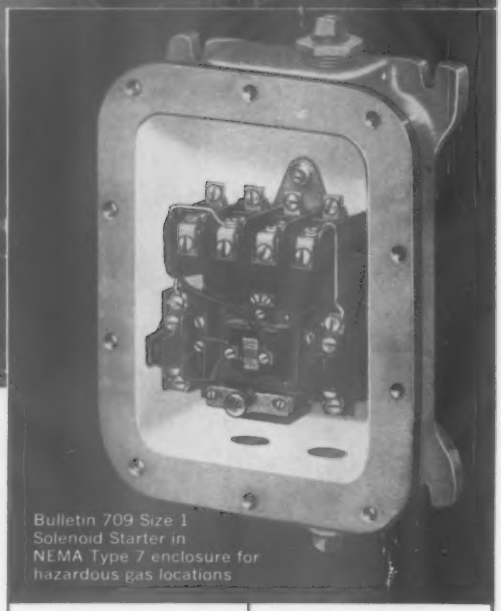

For Maximum Protection in Hazardous Locations ...ALLEN-BRADLEY Quality Motor Control

In explosive atmospheres, removing bolted enclosures for inspection or maintenance can be both costly and time-consuming —especially if safety precautions require extensive preparation and shutting down operations prior to servicing. With the trouble free performance of Allen-Bradley quality motor starters, this trouble is eliminated.

The simplicity of the famous A-B solenoid design—with only ONE moving part—is your assurance of millions of dependable operations. And the double break, silver alloy contacts—used in *all* A-B controls—are always in good operating condition—*require no attention whatever!*

In addition, all A-B starters are equipped with two or three permanently accurate thermal relays that protect motors against dangerous overloads. And the reliability of these relays is unaffected by atmospheric conditions or length of time in service.

To guard your equipment, your operations, and your operating people, insist on Allen-Bradley—the motor control built to be installed and forgotten.

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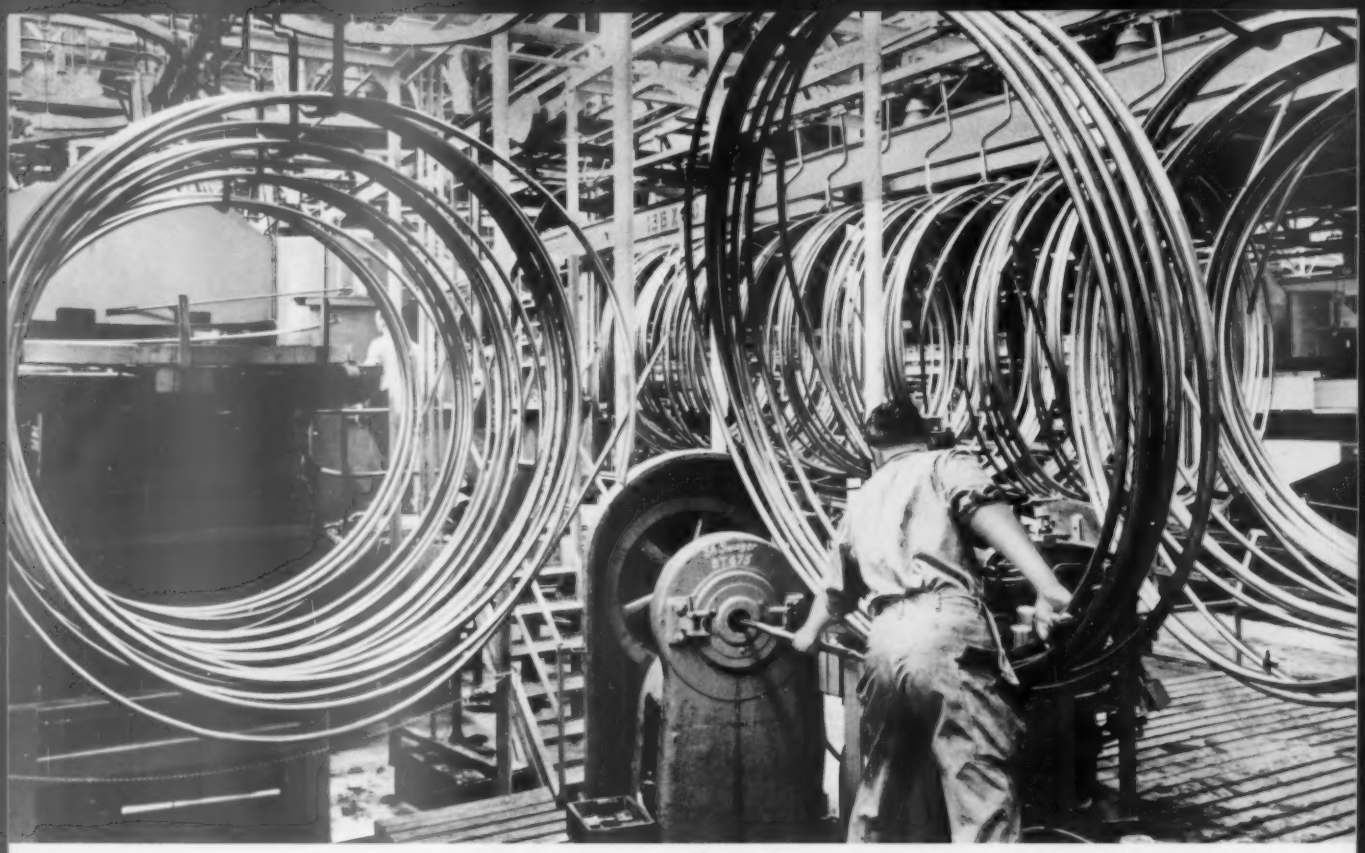

things you should know about

WOLVERINE TUBE

You know what they say—about change being the father of progress.

Well, that's the way it is at Wolverine Tube and we'd like to tell you about some of the new things going on at Wolverine.

For example, Wolverine recently completed a multi-million dollar modernization program at its Detroit, Michigan plant to serve its customers faster and better. New machinery and new tube-making techniques have made this plant one of the most modern in North America. Wolverine also operates large, modern plants in Decatur, Alabama and London, Canada.

There are new things afoot metalwise at Wolverine, too. In addition to copper and aluminum, Wolverine Tube now works in such metals as titanium, zirconium, columbium, tantalum and molybdenum. Wolverine considers this work so important that it has opened a new plant in Inkster, Michigan (Suburb of Detroit) devoted solely to manufacturing and development of these special metals . . . with specific emphasis on titanium and zirconium. It's the result of an extensive research program started many years ago, and it gives Wolverine customers a big edge when they require an experienced tubing and fabrication source for tomorrow's metals—TODAY.

Also, to insure top-flight sales service, Wolverine has expanded its nationwide sales staff to include a number of highly trained Heat Transfer Specialists. These men, along with other members of Wolverine's Field Engineering Service, are specialists in all phases of tubing selection and application, particularly in the field of heat transfer. Their services are available at all times . . . you only have to ask.

So . . . if your company is looking for the finest of tubing and the finest of service, you'll find both at Wolverine Tube where "improvement is a continuing program".

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Experience, dependability, engineering, research – if these are the things you look for when specifying heat exchanger tube you'll find them–in full measure–at Wolverine Tube. You'll find, in addition, a wide selection of tubing types–each designed to help you increase heat transfer efficiency. These tubes are illustrated and described on this page. You can choose any . . . or all of them . . . secure in the knowledge that no finer tubing is made. May we have your next order?

PRIME SURFACE TUBE

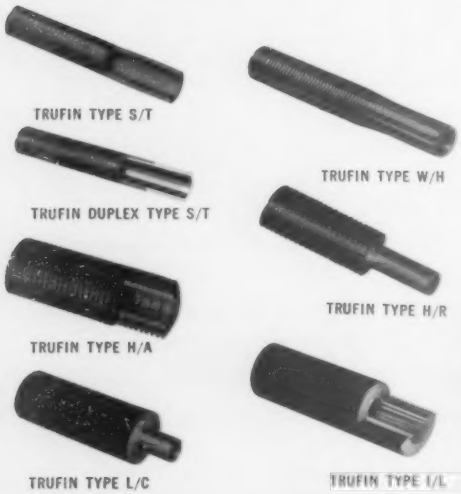
Wolverine prime surface heat exchanger tube is available in a wide range of sizes in copper, copper alloys and aluminum alloys. It is produced to ASTM Specifications B-111.

DUPLEX PRIME SURFACE TUBE

Composed of inner and outer tubes of dissimilar metals this tubing is specifically designed to handle two different corrosive conditions at the same time. The metal combinations can be those required to combat your corrosion problems.

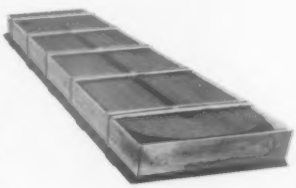
WOLVERINE TRUFIN®—THE INTEGRALLY FINNED TUBE

Wolverine Trufin — the original integrally finned tube is manufactured in 7 different types. It is available in external helical low or high fin form or with internal, longitudinal fins. Your Wolverine Sales representative will give you the *complete* story — just ask him next time he calls.



WOLVERINE U-BEND PALLETS

Here is real convenience. Working to your specifications, Wolverine prefabricates these tubes and ships them to you in disposable box-type pallets — *in* the exact order of unit installation. They're real time savers that also help you reduce tube inventory. Wolverine U-bends are available in both finned or prime surface form.



WOLVERINE FIELD ENGINEERING SERVICE

This is a Wolverine "extra"—a staff of highly trained tubing technicians, ready at all time to help you solve heat transfer problems dealing with tubing alloys, corrosion or design. Just ask for their services . . . there is no obligation.

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LITE-WATE

A Complete Low Density Cement that is

HIGHLY IMPERMEABLE

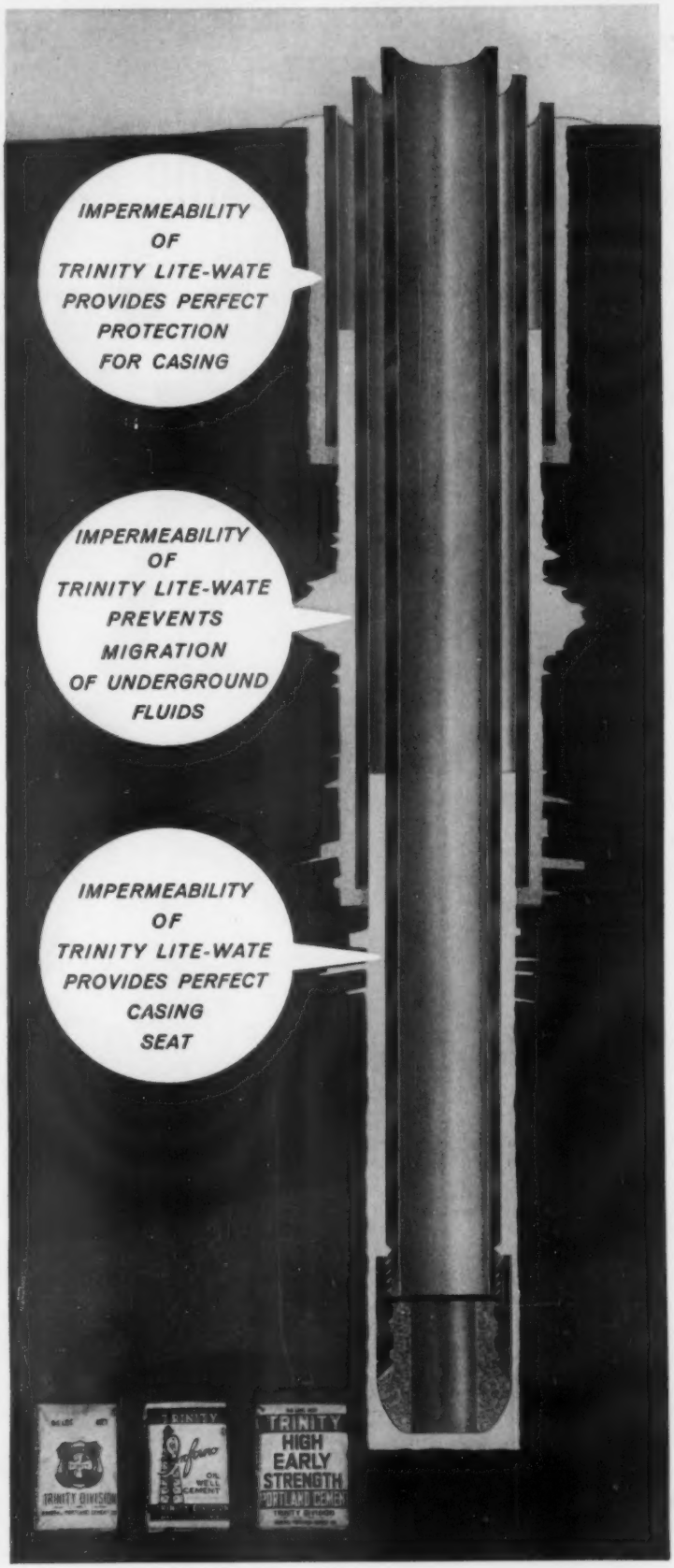
Trinity Lite-Wate fulfills all important functions when placed in an oil or gas well.

PERMEABILITY TEST DATA

All slurries were prepared according to procedures of API RP IOB and cured at 140°F and atmospheric pressure for 72 hours.

Percent Mixing Water	Slurry Wt. Pounds Per Gallon	Permeability Millidarcys*
65	13.66	0.001
75	13.18	0.001
85	12.77	0.001
95	12.44	0.001
105	12.14	0.002
115	11.89	0.003

*A darcy is that measurement of permeability that will permit a liquid having a viscosity of one centipoise to flow at the rate of one milliliter per second through a specimen one centimeter in length and having a cross section of one square centimeter under a pressure difference of one atmosphere. A millidarcy is 0.001 darcy. The permeability of Trinity Lite-Wate cement is expressed in millidarcys.


IMPERMEABILITY OF TRINITY LITE-WATE PROVIDES PERFECT PROTECTION FOR CASING
IMPERMEABILITY OF TRINITY LITE-WATE PREVENTS MIGRATION OF UNDERGROUND FLUIDS
IMPERMEABILITY OF TRINITY LITE-WATE PROVIDES PERFECT CASING SEAT
TRINITY DIVISION
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TRINITY
HIGH EARLY STRENGTH
PORTLAND CEMENT

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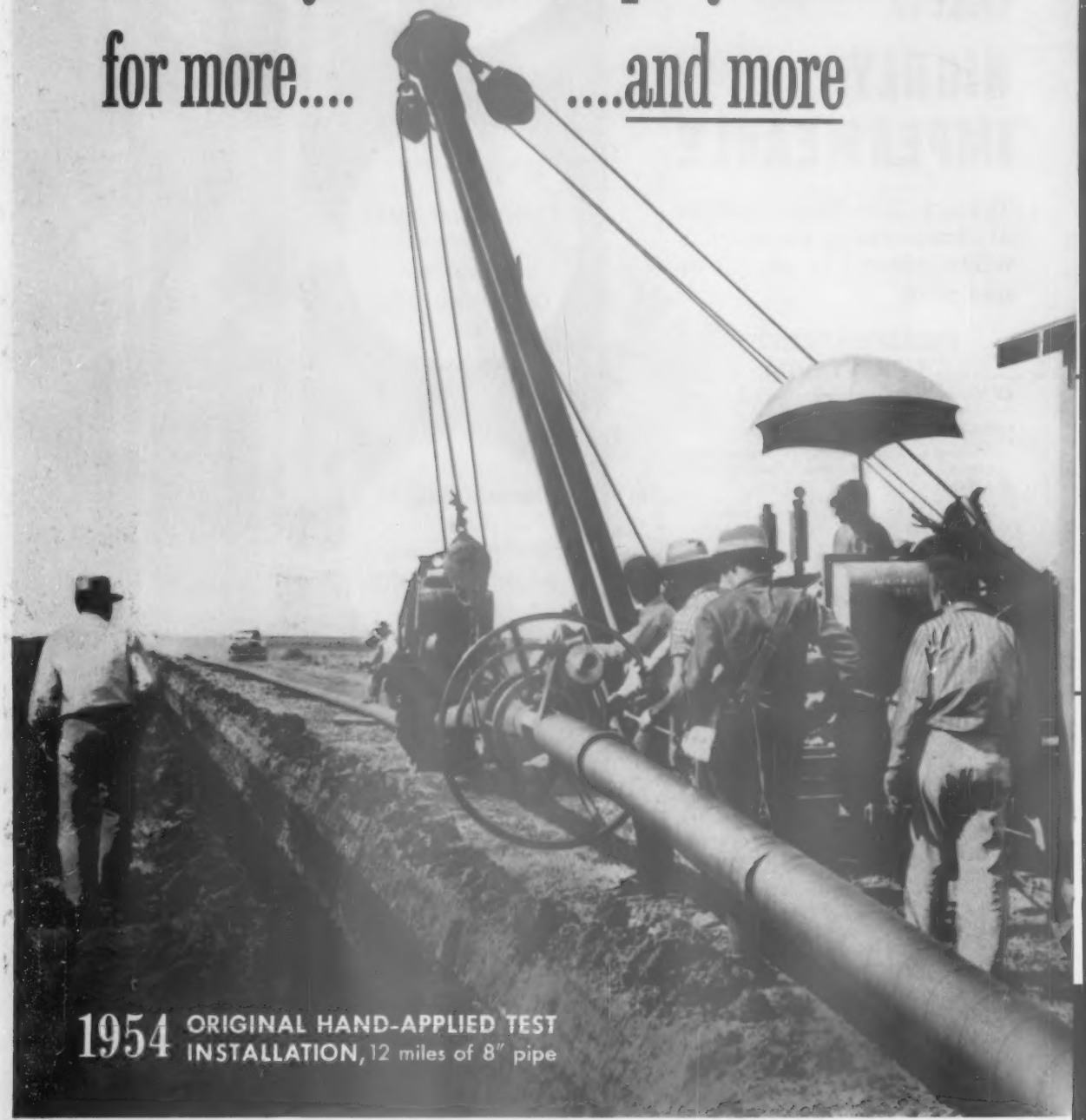
DALLAS·FT.WORTH·HOUSTON

POLYKEN PROTECTION—METHOD OF PROVEN PERFORMANCE

Seadrift coating job rated tops over the years...so company comes back for more.... ....and more



1954 ORIGINAL HAND-APPLIED TEST INSTALLATION, 12 miles of 8" pipe

Bell hole examination convinces second firm, too, to make important use of Polyken protection!

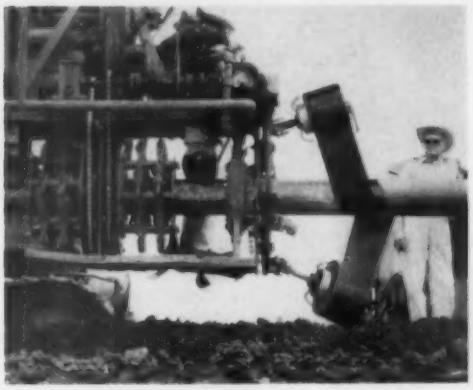
Proof of dependable performance . . . most graphic endorsement of Polyken. Case in point: In 1954, Seadrift Pipeline Co. set up a test installation of 12 miles of 8" gas pipeline from Bee County to Seadrift, Texas, wrapped with Polyken #900 Black. Its fine performance through subsequent years, as demonstrated by very satisfactory cathodic protection requirements and the absence of corrosion, made Polyken the choice again for the company's line from Live Oak County to Seadrift (31 miles of 6") in 1957.

Then, in 1960, continuing good cathodic protection results, confirmed by a bell hole examination of the original 8" job, proved Polyken tape still in *top-rated* condition after 6 years. No rust or corrosion on pipe. Tape itself showed no sign of time-wear or deterioration.

These jobs were labeled "very successful installations". With all this evidence at hand, Seadrift officials again put Polyken protection to work on their 1960 projects—more than 300 miles of 6" and 8". And engineers from another major pipeline company, present at the above bell hole inspection, developed their own conviction of the durable protection of Polyken on the basis of this 6-year experience. They ordered this *proven performance* coating for an important part of their new products line in Iowa.

The key to these decisions is performance—proven performance. That's why the growing list of Polyken users includes some of America's most exacting firms. Get the full details on Polyken performance and economy from your Polyken representative, or write Polyken Sales Division, 309 West Jackson Blvd., Chicago 6, Ill.

1957 ANOTHER SEADRIFT INSTALLATION, 31 miles of 6" pipe



1960 STILL ANOTHER SEADRIFT INSTALLATION, more than 300 miles of 6" and 8" pipe

1960 ANOTHER MAJOR PRODUCTS PIPELINE INSTALLATION, on 8" pipe

Polyken®

Experienced in modern PROTECTIVE COATINGS

THE KENDALL COMPANY
Polyken Sales Division

They Say—

Goggleless grinder

Dear Sir:

A plague on the safety department of the Newport News Shipbuilding & Dry Dock Co.

Re: Their ad on page 22 of the January 30 issue of The Oil and Gas Journal.

No goggles!

Earl McIlroy
Superintendent
Crude-Oil Division
Loudon Pipeline Co.
Mount Vernon, Ill.

It's better than we said

Dear Sir:

We note that The Oil and Gas Journal still estimates Neutral Zone production at 135,000 bbl. daily. During the month of November the Neutral Zone actually produced at the rate of 149,219 bbl. per day and December daily production was 154,405 bbl. per day.

The field is capable of producing in excess of 160,000 bbl. per day. Due to import restrictions we, of course, could not produce that capacity.

We would appreciate it if you could, in the future estimates of Neutral Zone production, use a potential of 165,000 bbl. per day.

E. A. Skarda
Getty Oil Co.

Chance to educate 'em

Dear Sir:

I read with interest your article in the January 30 Oil and Gas Journal on the Wisconsin wildcat program (p. 221).

Here is an excellent opportunity for the Journal to render an educational assist to the oil industry's public relations campaign.

The Milwaukee Journal has been a vocal and long time critic of depletion allowances and other so-called "loop hole" tax benefits for the industry.

I suggest you accumulate the cost information for the unsuccessful project along with other industry

the OIL AND GAS JOURNAL

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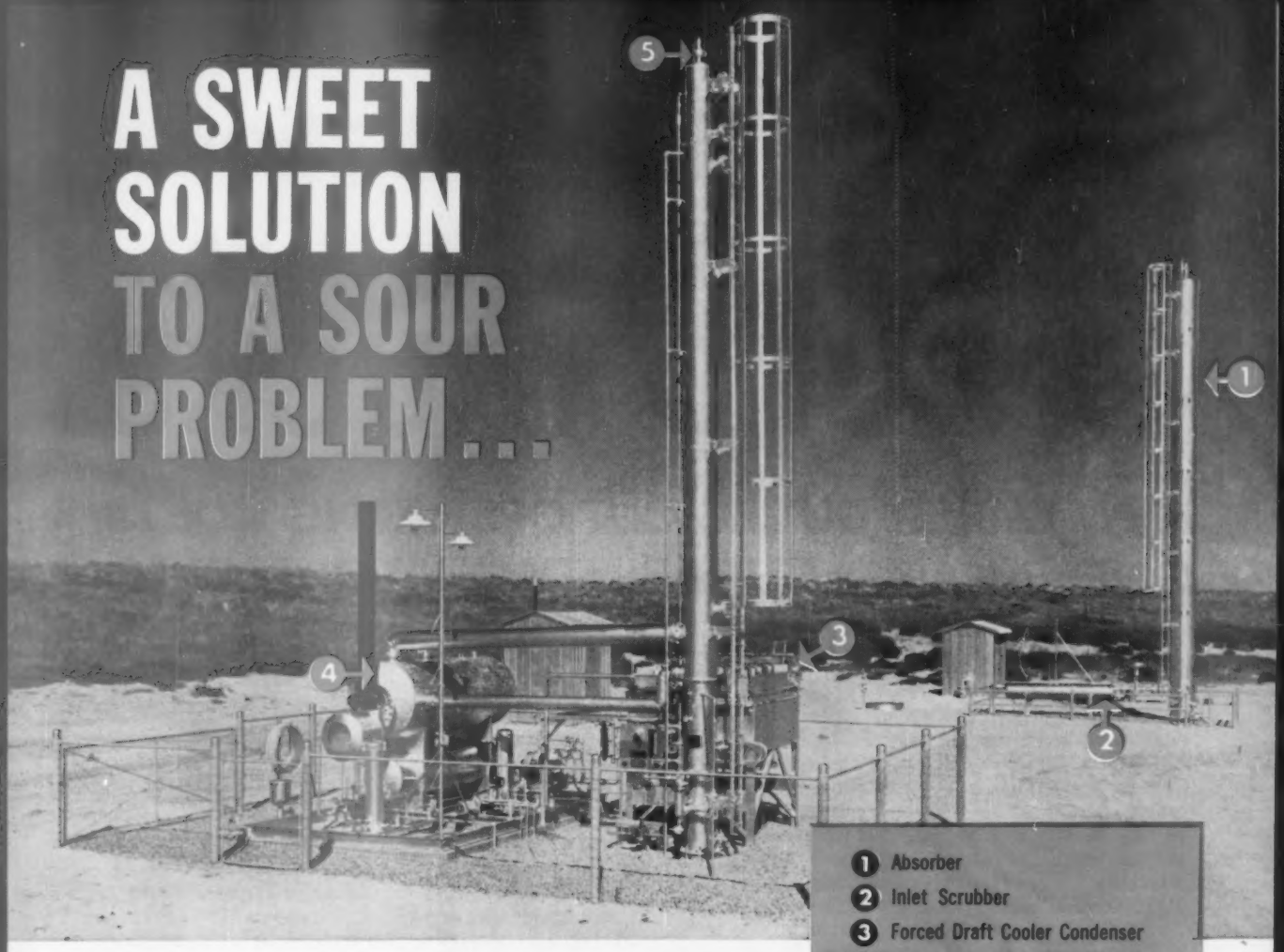
A SWEET SOLUTION TO A SOUR PROBLEM...



1. Absorber
2. Inlet Scrubber
3. Forced Draft Cooler Condenser
4. Reboiler
5. Still Column

This unit which processes 4 MMSCFD at 180 Psig. is located in the Hugoton Gas Field, and operates on a completely unattended basis.

BS&B Desulfurizers with Corrosion Control ... Standard for the Industry

Among gas processing people, BS&B is known for *conservative* design. What does this mean to you? . . . It means that day after day, year after year you get excellent service from your process equipment. It means the quality is built in . . . not brushed on.

Here's why BS&B has sold more desulfurizers than any other manufacturer in the industry:

- *All vessels and welded connections fully stress relieved.*
- *Lowest practical regeneration temperatures.*
- *Control of suspended solids by filtration.*
- *Oxygen block-out from atmosphere.*
- *Low solution velocities in heat exchanger.*
- *All Amine solution returned through a reclaimer, if desirable.*

Ask your local representative or write to Black, Sivalls & Bryson, Inc., Dept. 1-A2B, P.O. Box 1714, Oklahoma City, Oklahoma.

BS&B

BLACK, SIVALLS & BRYSON

OKLAHOMA CITY • EDMONTON • LONDON • PARIS • THE HAGUE

Save on oil exploration and production costs with '61 FORD TRUCKS

NEW SUPER DUTIES CUT OPERATING COSTS, GIVE PROVEN DURABILITY THAT'S BACKED BY A 100,000-MILE ENGINE WARRANTY

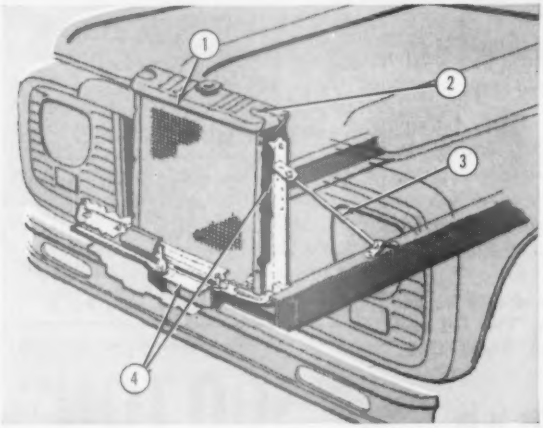
New 100,000-mile warranty on Super Duty V-8 gas engines is the most liberal in the industry. On 401-, 477- and 534-cu. in. V-8's, Ford Dealers will replace any major engine part (including block, heads, crankshaft, bearings, valves, pistons, rings) found to be defective in materials and workmanship providing trucks are used in normal service. The warranty covers full cost of replacement parts for 100,000 miles or 24 months, whichever occurs first . . . full labor costs for first year or 50,000 miles, sliding percentage scale thereafter. Never before have you had such protection . . . such evidence of long term durability!

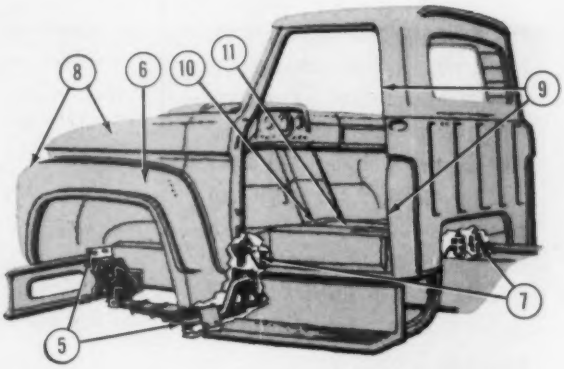
And you save with greater gas economy! Certified tests prove the new Super Duty V-8's give up to 20% better mileage. In addition, Ford's new lightweight, *extra hi-tensile* single-channel frames (standard F-850—F-1000) give you long-lived durability combined with a lightness of weight for added payloads. All in all, you get proven components and design features . . . in trucks built for easier maintenance and lower running costs.

Save with Ford T-Series Super Duty Tandems for exceptional durability, big payloads and low operating expenses. Ford T-850 and T-950 Tandems with Super Duty V-8 engines have rugged double-channel, hi-tensile frames for maximum strength, minimum weight. And they provide a wider range of chassis options so you can choose the right power train and load-carrying components for any job. Eaton and Timken rear axles are now available in bogie assemblies with up to 38,000-lb. capacity. And lightweight aluminum walking beams, wheels and gas tanks are available to keep chassis weights low . . . payloads high.

Ask your dealer about Ford's full tandem line... five T-Series with GVW's ranging from 28,000 lb. to 51,000 lb. and GCW's to 75,000 lb.

SAVE WITH NEW HEAVY-DUTY CONSTRUCTION THAT DOUBLES CAB, SHEET METAL AND RADIATOR LIFE





(1) **Save with Ford's exclusive "lock-seam" radiator construction** that doubles the solder area at key seams for greatly increased strength and longer radiator life.

(2) **Save with heavier-gauge metal on radiator tank and header.** Upper and lower tanks and header have thicker walls to resist vibration, jolts and corrosion for greater reliability.

(3) **Save with independent radiator mountings,** separate from front-end sheet metal. This means that road shocks, vibrations and shakes are not transmitted to the radiator through sheet metal . . . tanks, tubes and connections last longer, require less maintenance.

(4) **Save with "horse collar" mounting** seated on rubber pad for extended radiator life. This new mounting on resilient rubber at the center of frame cross member soaks up any frame flexing . . . cuts wear and tear on entire cooling system.

(5) **Save with independent fender mountings.** Fenders are bolted to a rubber-cushioned transverse bracket at the front and a frame-mounted bracket at the rear. This mounting, independent of both cab and radiator, eliminates stress transfers for greatly increased fender life.

(6) **Save with removable fenders.** The quick and easy removal of only 8 bolts per fender provides faster service accessibility to the engine area, saving valuable maintenance time.

(7) **Save with new 3-point cab mounting system** for greater cab durability. Two outboard front mounts plus a centered "twin" rear mount provide a triangular system that holds the cab stationary while allowing the frame to move independently . . . reducing strain on the cab.

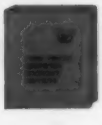
(8) **Save with 42% heavier-gauge sheet metal** in fenders, hood, cab floor pan and toeboard for greater strength, greater durability.

(9) **Save with stronger cab construction.** New full-length door pillar reinforcements provide increased cab rigidity, stamina.

(10) **Save with a more solid foundation.** 42% thicker sheet metal is used in the integral floor pan and toeboard, this with added floor reinforcements gives a stronger base for longer cab life.

(11) **Save with new transmission access panel** to cut transmission service time.

FORD TRUCKS COST LESS



YOUR FORD DEALER'S "CERTIFIED ECONOMY BOOK" PROVES IT FOR SURE...

FORD DIVISION, *Ford Motor Company*

Now*... measure levels of any liquid in any container with this hermetically sealed

"dripless dripstick"

From table oils to toxic chemicals, the FRI "dripless dripstick" can accurately measure the contents of any container. Throughout the petroleum and chemical industry, wherever liquid levels must be determined, this easy-to-read indicator can do the job faster, safer, and with absolutely no contact of the indicator rod with the liquid to be measured. **Fully Tested in Use*

How does it work? A doughnut shaped magnetized float (A) surrounds a guide tube (B) and rides the level of the liquid. A calibrated rod with a magnetic tip (C) is pulled out until magnets (A) and (C) engage. Then, the liquid level is read at point (D) outside the container. Request specifications and prices on your letterhead.

Mounts Top or Bottom

Flight Refueling, Inc.

COMMERCIAL PRODUCTS SECTION
BOX 1701 • BALTIMORE 3, MD.

cost information and present it to the editors of the Milwaukee Journal for their education.

Deane Baker
Executive Assistant
to the President
Somerville Construction Co.
Ada, Mich.

Right photo in wrong place

Dear Sir:

The picture on page 82 of the January 16 issue is very interesting. I rather doubt, though, that this fine unit will make much ethylene for Gulf . . . you see, the unit pictured is Continental's new cyclohexane unit at Ponca City.

John M. Griffith
Corrosion Engineer
Continental Oil Co.
Ponca City, Okla.

He's right. Gulf's Port Arthur, Tex., ethylene unit is pictured on page 98 with a story about (you guessed it) Conoco's new cyclohexane unit. The captions were inadvertently switched.—Ed.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

FEBRUARY

20-Mar. 11	Advanced Drilling Practices Course for Engineers, University of Oklahoma, Norman.
23-24	Oklahoma State University, natural gas conference, Stillwater, Okla.
23-24	Chemical Institute of Canada, conference of the protective coatings division: Toronto, Feb. 23; Montreal, Feb. 24.
23-25	Canadian Pipe Line Contractors Association, meeting, Empress Hotel, Victoria, B.C.
24	Natural Gasoline Association of America, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette, La.
26-Mar. 1	American Institute of Chemical Engineers, petrochemical and refining exposition, Municipal Auditorium, New Orleans, and national meeting, Hotel Roosevelt, New Orleans.
26-Mar. 2	American Institute of Mining, Metallurgical, and Petroleum Engineers annual meeting, Chase and Park Plaza Hotels, St. Louis.
27	Canadian Society of Exploration Geophysicists, conference on exploration geophysics—today and tomorrow, Palliser Hotel, Calgary.
28-Mar. 1	API Committee on Public Affairs, New York regional conference on

P.T.C.

BrakeSol INC.

PARAFFIN TREATING CHEMICAL

For Paraffin Control

HOLDS PARAFFIN IN SUSPENSION

AT SUPPLY STORES

BrakeSol REG. U.S. PAT. OFF. **INC.**

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OKLAHOMA CITY, OKLAHOMA

"500 TON"
TOOL JOINT COMPOUND
"POLARIZED"

additive increases "clinging" power for greater thread protection under mud and water pressures!

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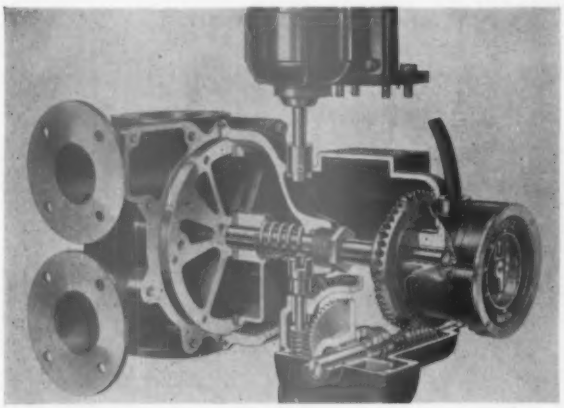
Leak-Proof Valve Lube

Inert Silicone Compound Cuts Valve Maintenance

For a long lasting valve lubricant . . . specify Dow Corning Valve Seal, a non-melting silicone compound that remains grease-like from —40 to 500 F. *Chemical resistance . . . heat stability . . .* and *water repellency* are just three of many reasons for using Valve Seal. *Inert* and *nonoxidizing*, it offers advantages in numerous applications . . . on outside lines . . . in low temperature processing . . . on delicate equipment and recording instruments.

Chemical Resistance. A large Southwest petrochemical plant depends on Dow Corning Valve Seal to prevent sticking and leakage in hundreds of angle and safety relief valves on railroad tank cars . . . other valves throughout the plant. Inert Valve Seal won't react with or contaminate such chemicals as ethylene and propylene oxides, ethyl, methyl and vinyl chlorides, butylene and butadiene. In process plants, too, silicones help prevent corrosion . . . speed operations and ease teardown of equipment.

Heat Stability. From —40 to 500 F, Dow Corning Valve Seal stays on the job . . . won't melt, run off or gum up. This excellent thermal stability helps assure tight packing seals on shafts of seven 2-speed mixers in a hydrocarbon section where temperatures range from 10 to 200 F. In the mixers where cuprous ammonium acetate and butadiene are combined, nonreactive silicones keep a tight seal and prevent contamination in the lines. Dow Corning Valve Seal also provides excellent resistance to oils and oxidation.



Water Repellency. Between rubber and bronze mating faces of valves in water conditioning equipment, this grease-like silicone compound provides an effective, leak-proof seal. With superior water resistance, the silicones protect parts from corrosion . . . increase service life and reduce maintenance. Silicones offer additional advantages: won't react with chemicals passing through ports, won't attack rubber or plastic parts, remain near-constant in viscosity in extreme temperatures.

Inert, Nonoxidizing. In contact with most chemicals or oils . . . in high heat or cold . . . in hot water or low-pressure steam . . . Dow Corning Valve Seal has been proved successful as a sealant, and lubricant. Applications include plug valves, control valves, flow meter bearings, plugcocks . . . other assemblies . . . pump packing impregnation. Valve Seal is available in 2-ounce and 8-ounce collapsible tubes, and in bulk containers of 10 pounds and 50 pounds. Investigate today.

For complete data on all silicone products, contact the Dow Corning office nearest you. Address Dept. 6214a.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

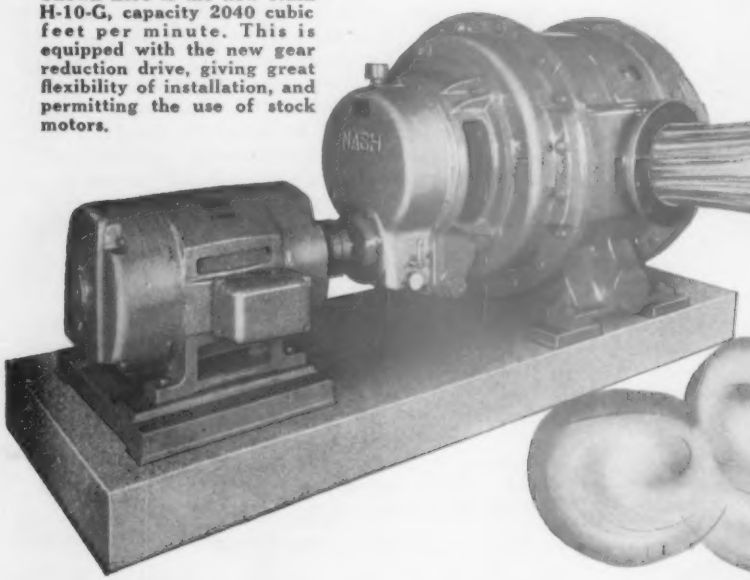
Nash Compressors Tame "Hard-to-handle" Corrosive Gases

The reasons for the success of Nash Compressors in handling "dirty" and corrosive gases are simple. First, Nash Compressors have no internal parts in wearing contact, or requiring close tolerances and internal lubrication. Second, because of the Nash operating principle, a variety of liquids can be employed as the compressant medium, protecting the interior from corrosive action. Third, the pump casing may be fabricated from a variety of special metals and alloys. That is why Nash Compressors take these rugged jobs in stride.

Nash Vacuum Pumps offer the same basic advantages when handling corrosive gases, and reliably maintain vacuums up to 29.50 inches of mercury.

ACETONE
ACETYLENE
AMMONIA
ARGON
BUTADIENE
CARBON DIOXIDE
CARBON MONOXIDE
CHLORINE
ETHYL CHLORIDE
FLUE GAS
FURFURAL
HEXANE
HELIUM
HYDROGEN
HYDROGEN SULPHIDE
NITROGEN
OXYGEN
PHOSPHOROUS PENTOXIDE
SULPHUR GAS
VINYL ACETATE
VINYL CHLORIDE
AND MANY OTHERS

Shown here is the new Nash H-10-G, capacity 2040 cubic feet per minute. This is equipped with the new gear reduction drive, giving great flexibility of installation, and permitting the use of stock motors.



NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

employe communications, Park-Sheraton Hotel, New York City.

MARCH

2 Petroleum Equipment Suppliers Association, north Mid-Continent district meeting, Mayo Hotel, Tulsa.

3 Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus.

3 Southern Gas Association, transmission section, annual spring management conference, Sheraton-Dallas Hotel, Dallas.

5-9 American Society of Mechanical Engineers, gas-turbine power division, and U. S. Department of Defense, annual gas-turbine conference and products show, Shoreham Hotel, Washington.

7 Petroleum Equipment Suppliers Association, Pacific district meeting, Ambassador Hotel, Los Angeles.

7-8 University of Oklahoma, School of Geological Engineering, seventh biennial geological symposium, Student Union Building, University of Oklahoma, Norman.

8-9 API Committee on Public Affairs, Chicago regional conference on employe communications, Sheraton-Towers Hotel, Chicago.

8-10 American Petroleum Institute, Division of Production, southern district meeting, Captain Shreve and Washington-Youree hotels, Shreveport, La.

13-16 Kentucky Petroleum Marketers Association, sixth management institute, conducted by the University of Louisville, Brown Hotel, Louisville.

13-17 National Association of Corrosion Engineers, annual meeting and corrosion show, Hotel Statler, Buffalo, N. Y.

15-17 Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas.

16-17 International Oil and Gas Educational Center, study of the economics of petroleum exploration, development, and property valuation, Southwestern Legal Center, Dallas.

20 American Gas Association, general management section conference, Francis Marion Hotel, Charleston, S. C.

21-23 American Power Conference, twenty-third meeting, Sherman Hotel, Chicago.

21-30 American Chemical Society, 139th annual meeting, Kiel Auditorium, St. Louis.

22 American Institute of Chemical Engineers, Chicago section, symposium on new developments for chemical processing and new developments for the engineer and management, Conrad Hilton Hotel, Chicago.

22-24 American Petroleum Institute, Division of Production, southwestern district meeting, Cole Hotel, Albuquerque.

23 National Industrial Conference Board, general session, Shamrock-Hilton Hotel, Houston.

23-24 North Texas Oil and Gas Association, annual meeting, Kemp Hotel, Wichita Falls, Tex.

27-28 University of Wichita, School of Engineering, third annual production institute, university campus, Wichita.

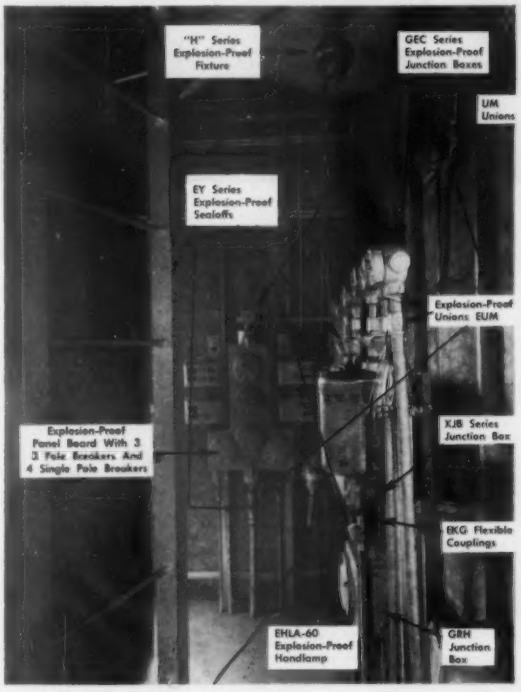
27-29 Midwest Gas Association, annual meeting and convention, Sheraton-Fontenelle Hotel, Omaha.

27-31 Instrument Society of America, symposium on temperature measurement and control in science and industry, Veterans Memorial Auditorium, Columbus, Ohio.

28-29 University of Oklahoma, Schools of

More and more refineries are turning to

KILLARK ELECTRICAL FITTINGS & FIXTURES for GREATER SAFETY MAXIMUM DURABILITY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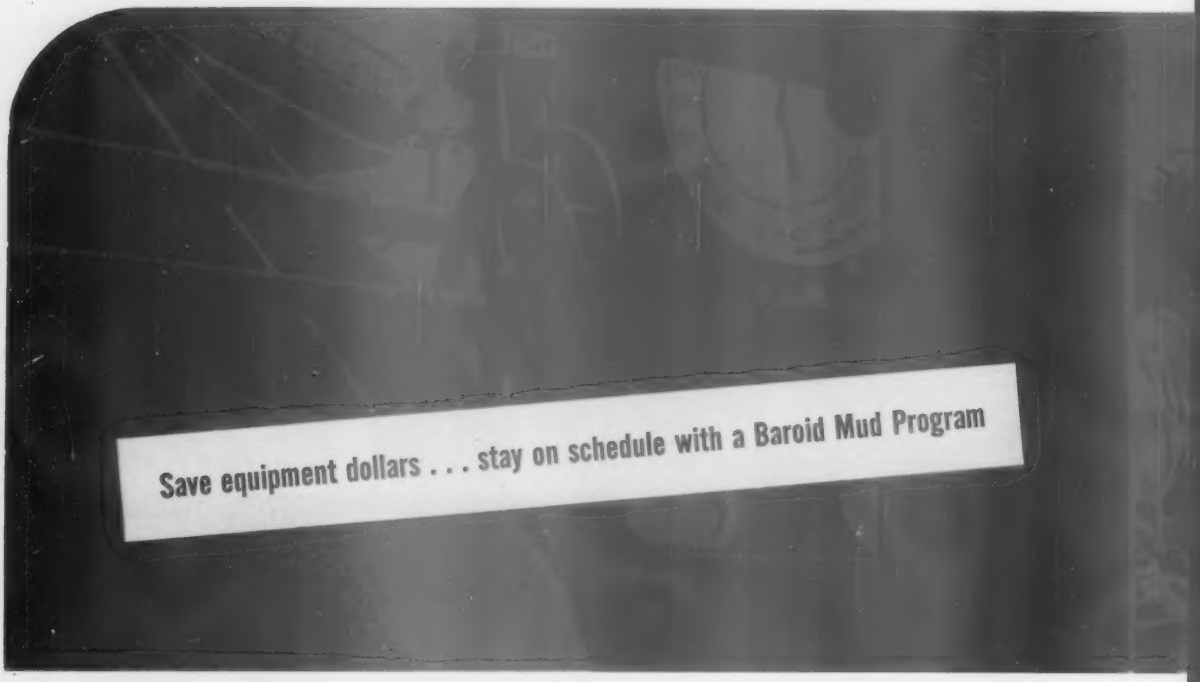

BAROID ENGINEERING SOLVES

Baroid Field Report: Cass County, Texas

MUD PROBLEM:

To overcome corrosion of drill pipe caused by hydrogen sulfide gas encountered in the producing zone

WELL DATA

LOCATION: Cass County, Texas

TOTAL DEPTH: 11,200′

PRODUCTION ZONE: Smackover Lime

CASING PROGRAM

SIZE, INCHES O.D.	DEPTH SET, FEET
9⅝"	3,987′
7"	11,200′ T.D.

MUD ADDITIVE PROGRAM

0′ to 11,000′	Gypsum-Q-BROXIN* emulsion mud, from normal conversion depth.
11,000′ to 11,200′	Continued use of gypsum-Q-BROXIN mud, with addition of X-COR** slug treatment of 2 lb/bbl (350 gal) added through pump suction.

TYPICAL MUD PROPERTIES

Depth, ft	11,095	11,117	11,200
Weight, ppg	11.0	11.0	11.0
Viscosity, cp	25	25	25
Plastic Viscosity, cp	20	17	20
Yield Point, lb/100 sq ft	3	5	0
Filtrate, API, cc	6.3	6.0	5.0
Hydrogen, ppm	1,200	900	1,000

*REGISTERED TRADEMARK, PUGET SOUND PULP & TIMBER CO.

PROBLEM: To prevent excessive corrosion of drill pipe exposed to hydrogen sulfide gas.

DISCUSSION: Sulfide gas contamination of drilling fluids is a serious corrosion problem in certain areas of Cass County, Texas, and many other areas. This gas is often found in the Smackover Lime, at approximately 11,000′ in the Cass County fields. The Smackover Lime is an oil productive zone, and the corrosive sulfides severely attack drill pipe and production equipment.

SOLUTION: In order to combat corrosion of drill pipe while drilling sulfide gas-bearing zones, it was necessary to add a corrosion inhibitor to the mud. X-COR was pilot-tested in the 11 lb/gal gyp-Q-BROXIN mud in use, and the results indicated no ill effects on the mud. A treatment of 2 lb/bbl (350 gallons) of X-COR was added through the pump suction and pumped through the drill pipe. The slug of X-COR applied in this manner resulted in good coating of the metal surfaces. Upon return to the surface, the X-COR mixed readily into the mud with no resulting change in flow properties of the mud. Metal coupons suspended in the mud pits allowed continuing observation for corrosive mud conditions. Results showed that pitting corrosion was eliminated and general corrosion was reduced to an insignificant rate of 1.9 mils per year. The drill stem, when pulled, showed that use of X-COR had prevented any substantial corrosion damage.

**TRADEMARK, BAROID DIVISION NATIONAL LEAD COMPANY

BAROID—*Still Pioneering Drilling Mud Research • Engineering • Marketing*

DRILL PIPE CORROSION PROBLEM

Baroid's new X-COR liquid mud additive effectively guards your equipment against corrosion due to effects of hydrogen sulfide gas (as in the case history at left) or from oxidation or electrolytes. X-COR can also reduce shale hydration by depositing a waterproof film on the hole wall and cuttings.

In this case history, typical of many, serious corrosion of equipment was resulting from exposure of metal surfaces to hydrogen sulfide gas found in the Smackover Lime formation at approximately 11,000 feet. In this instance, X-COR was added to the system when pilot tests indicated the corrosive formation was entered. A slug treatment of only 2 lb/bbl of X-COR was added easily and safely. There was no change in flow properties of the mud, and the drilling string was effectively protected.

The tenacious, waterproof film deposited by X-COR not only protects down-hole equipment and reduces shale hydration, but it will serve effectively in packer fluids to ward off corrosion by fluids left in the casing/tubing annulus. Make-up waters frequently contain corrosive sulfides. X-COR is effective in brine or salt water fluids used in drilling, workover and completion operations. In muds, X-COR does not fluoresce, does not significantly change drilling fluid properties and is compatible with all water-base drilling fluids now commonly used.

X-COR applied as a sprayed, painted or wiped-on film will effectively prevent corrosion of drill pipe and casing exposed to weather.

X-COR demonstrates again that Baroid's new customer-oriented program of research and marketing is giving you products and services that save you money. For full technical details on X-COR, write for data sheet.

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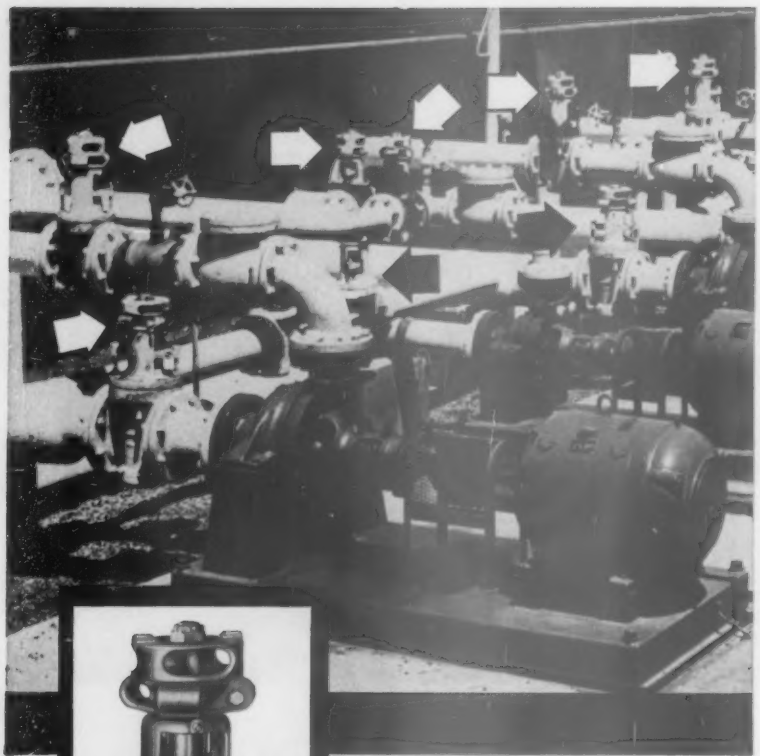

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HAMER LINE BLIND VALVES

HAMER PLUG VALVES

Petroleum and Gas Engineering, gas conditioning short course, Oklahoma Memorial Union Building, University of Oklahoma, Norman.

APRIL

- 4 Instrument Society of America, New Jersey section, annual symposium on electronic process instrumentation, Hotel Essex House, Newark, N. J.
- 4-5 University of Kansas, gas compressor Institute, Liberal, Kans.
- 5-6 Third annual symposium on pilot plant and process automation, Ambassador Hotel, Los Angeles.
- 5-7 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Mayo Hotel, Tulsa.
- 6-7 University of Oklahoma, School of Mechanical Engineering, short course on industrial engines, University of Oklahoma, Norman.
- 6-8 Texas Oil Jobbers Association, Petroleum Marketers Association, convention and trade show, Baker Hotel, Dallas.
- 7-9 American Institute of Mining, Metallurgical, and Petroleum Engineers, Southwestern Alaska Chapter, sixth annual mining, minerals, and petroleum conference, Anchorage, Alaska.
- 10-11 American Society of Mechanical Engineers, maintenance and plant engineering conference, Bancroft Hotel, Worcester, Mass.
- 10-12 Western Petroleum Refiners Association, annual meeting, Granada Hotel, San Antonio, Tex.
- 10-13 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Jung Hotel, New Orleans.
- 11-13 Petroleum Industry Electrical Association and Petroleum Electric Supply Association, annual conference, Moody Convention Center, Galveston, Tex.
- 17-19 Instrument Society of America, symposium on instrumental methods of analysis, Shamrock-Hilton Hotel, Houston.
- 18-20 University of Oklahoma, southwestern gas measurement short course, North Campus, University of Oklahoma, Norman.
- 19 University of Tulsa, fifteenth annual conference of accountants, University campus, Tulsa.
- 19-20 National Petroleum Association, semiannual meeting, Hotel Sheraton-Cleveland, Cleveland.
- 20-21 Society of Petroleum Engineers of AIME, East Texas-Louisiana-Arkansas gas-technology symposium, Tyler, Tex.
- 20-21 Texas Technological College, annual West Texas oil lifting short course, Lubbock, Tex.
- 20-22 Illinois Society of Professional Engineers, annual convention, Peoria, Ill.
- 24-26 Southern Gas Association, meeting, New Orleans.
- 24-27 American Association of Petroleum Geologists, Society of Economic Paleontologists, and Rocky Mountain section of AAPG, annual meeting, Denver Hilton Hotel, Denver.
- 26-28 American Petroleum Institute, Division of Transportation, pipeline conference, Chase-Park Plaza Hotel, St. Louis.
- 27-28 Rocky Mountain Oil and Gas Association, midyear meeting, Northern Hotel, Billings, Mont.
- 28 Natural Gasoline Association of America, Oklahoma regional meet-

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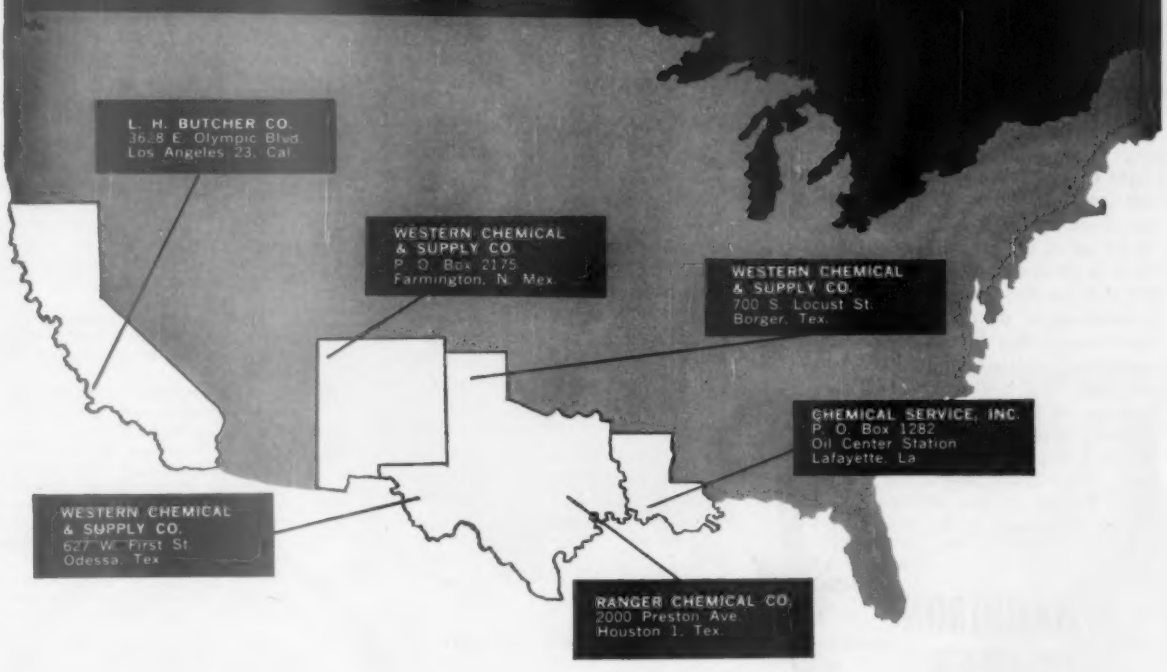

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ing, Lake Murray Lodge, Ardmore, Okla.

30-May 2 Independent Petroleum Association of America, midyear meeting, Roosevelt Hotel, New Orleans.

30-May 3 Liquefied Petroleum Gas Association, convention and trade show, Conrad Hilton Hotel, Chicago.

MAY

2-4 Purdue University, School of Civil Engineering, sixteenth industrial-waste conference, Purdue Memorial Center, Lafayette, La.

3-5 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone-Henning Hotel, Casper, Wyo.

4-5 Society of Petroleum Engineers of AIME, oil recovery conference, Midland, Tex.

4-5 Pacific Coast Gas Association, Inc., transmission conference, Biltmore Hotel, Santa Barbara, Calif.

7-10 American Institute of Chemical Engineers meeting, Sheraton-Cleveland Hotel, Cleveland.

8-11 American Petroleum Institute, Division of Refining, midyear meeting, Rice Hotel, Houston.

9-11 Western Joint Computer Conference and Exhibit, Ambassador Hotel, Los Angeles.

10-12 American Society of Mechanical Engineers, production engineering conference, Royal York Hotel, Toronto.

10-12 Canadian Institute of Mining and Metallurgy, oil and gas division, and Calgary and Edmonton petroleum engineering sections of Canadian Institute of Mining and Metallurgy and American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, McDonald Hotel, Edmonton, Alta.

11-12 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

14-17 Texas Independent Producers and Royalty Owners Association, Scharbauer Hotel, Midland, Tex.

16-19 American Petroleum Institute, Division of Marketing, midyear meeting, Americana Hotel, Miami Beach.

17-19 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Hotel Lassen, Wichita.

19 Natural Gasoline Association of America, Permian Basin regional meeting, Lincoln Hotel, Odessa, Tex.

21-24 American Petroleum Institute, Division of Transportation, midyear highway conference, Bellevue Stratford Hotel, Philadelphia.

24-25 Western Petroleum Refiners Association, computer conference, Ben Franklin Hotel, Philadelphia.

25-26 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual Rocky Mountain petroleum sections, joint meeting, Salt Lake City.

JUNE

1-2 Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

5-6 Petroleum Electric Power Association, meeting, Mayo Hotel, Tulsa.

6-8 Instrument Society of America, summer instrument-automation conference and exhibit, Royal York Hotel and Queen Elizabeth Hall, Toronto.

6-8 Sixth annual Appalachian underground corrosion short course, West Virginia University, School of Mines, Morgantown, W. Va.

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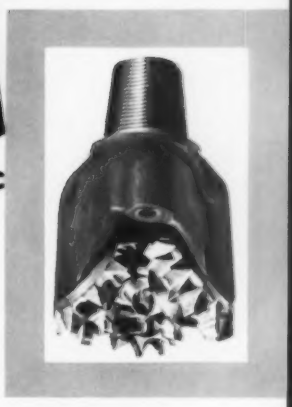

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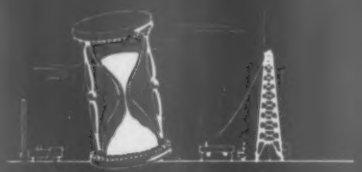

the Journal said...

50 years ago

February 23, 1911

Impassable road conditions throughout West Virginia and southeastern Ohio oil and gas areas have forced the shutting down of all drilling operations except those where all equipment, materials, and supplies already are on location.

Two excursion trains are being run to the new gas field in Fayette County, northwestern Alabama, to accommodate the crowds of visitors expected to watch Peoples Gas Co., Birmingham, the owner, shoot and bring in what the company hopes will be a gusher oil well, the first in the state. One excursion is being run from Tuscaloosa, Ala., and the other from Columbus, Miss. (Editor's note: The well didn't make it.)

The Texas Co. announces it has outgrown the 10-story Jones building it now occupies under lease at Houston, and is moving its refining department to the new Carter building, and its Southern district sales department to the Levy building. Plans are in the making for erection of a new company building to bring all departments together again.

25 years ago

February 20, 1936

New Trinity-sand oil discovery at Talco in Titus County, East Texas, sets off fastest and most spirited leasing and royalty-buying campaign in district's history. Strike by C. N. Housh and E. G. Thompson at 4,208 ft. has earmarks of major find.

Rotary tools make debut in Pennsylvania and New York to combat the problem of high gas pressures encountered in drilling and completing wells in the deeper Oriskany sands.

Booming Rodessa field of northwestern Louisiana takes top place in country's oil development as new extensions stretch producing area 10 miles long and more than 3 miles wide. Six refining and natural-gasoline plants under construction in field where 71 oil wells have been completed in less than 6 months.

10 years ago

February 22, 1951

William J. Sherry, Tulsa geologist and independent operator, acquires all outstanding stock in J. E. Crosbie, Inc., one of the Southwest's oldest independent oil companies. Consideration is in excess of $5,000,000. In turn, Sherry sells most of the firm's physical properties to Kerr-McGee Oil Industries, Inc., Oklahoma City drilling contracting firm.

Atlantic Refining Co. introduces significant new catalyst reforming process designed to improve motor-fuel quality, conserve crude resources, and give a higher degree of flexibility in operation.

JOURNALLY SPEAKING

Smog Gets In Your Eyes

AN IMPORTANT PART of the daily weather report in Los Angeles' newspapers is a line which reads: "Today's smog forecast: . . ."

Some days the forecast is for light - to - moderate eye irritation. Other days things are clear. And then there are days when you shoulda stood in bed due to the heavy smog.

These weather reports are as much a part of daily life in Los Angeles as the newspapers which carry them. And smog is part of daily life, too. True, smog is not there every day, only on those days when there is a "temperature inversion" and a layer of warm air puts a lid over the city. This layer of warm air traps pollutants emitted into the atmosphere. It just takes a little breeze to lift the lid and let the pollutants escape, but until you get the breeze, you have smog.

The oil industry probably has paid the biggest price in the fight to control smog. All refineries in the Los Angeles Basin are equipped with facilities to remove pollutants before emissions are sent into the air. And there's a smog rule which tells you how much sulfur you can have in your gasoline. Another rule says you can't burn fuel oil from May 1 to November 1.

In fact, any mention of the use of petroleum or its products in Los Angeles always brings into consideration how this use will affect smog.

All this has earned Los Angeles the undisputed title of "Smogville, U.S.A." But it looks as if Los Angeles may be able to hand over its title to some of the challengers.

Yes, the end of smog is in sight. The state's Motor Vehicle Pollution Control Board is moving swiftly toward its goal of certifying afterburners to control the amount of hydrocarbons and carbon monoxide coming out the exhaust pipes of automobiles.

Once the auto-exhaust program is in effect, then the last major source of smog will be controlled.

There are several cities which may get the label now tagged exclusively on Los Angeles. Some of these potential smog champions are New York, Cleveland, Pittsburgh, Chicago, and Washington, to name a few. A foreign contender is Paris.

These names are not brought forward by some Los Angeles civic leader who would like to see his city rid of the smog title. No, the authority on the subject is a midwesterner, M. P. Venema, chairman of Universal Oil Products Co., Inc.

Venema mentioned these cities and their growing air - pollution problem during a recent visit to Los Angeles. He didn't say in so many words that smog in these cities would be as bad as it has been in Los Angeles, but he left no doubt they have a growing pollution problem.

The UOP chairman said two things which show how strongly he feels about the growing smog problem. First, he predicted some day "we'll have smog legislation all over the country." Then he went on to say his company is tooling up for the mass production of auto afterburners even though UOP doesn't have authority as yet to sell them in California. UOP figures there eventually will be a market outside California.

The moral of the story is this: The next time someone tells a Los Angeles smog joke, don't laugh until you cry. The day may come when smog is no joke in your city—but you'll be crying anyhow.

—*Carl J. Lawrence*

(Our West Coast editor isn't joking about smog, either. He's probably crying about what he and other Los Angeles motorists will be up against during the next couple of years. Carl spells out the auto-exhaust-control project in detail on page 86.

(And call it happy coincidence or close coordination, but starting on page 105, Refining Editor Dave Stormont fills a 12-page section with data on how refiners are spending millions every year to control air pollution. This is quite a smoggy issue.)

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Refiners' chickens are coming home to roost

REFINERS are now paying the penalty for their shortsightedness in maintaining high runs last summer and fall.

The severe January weather in the Northeast has had the side effect of pushing gasoline stocks to dangerously high levels.

Unless drastic measures are taken, gasoline prices will be on the skids and the entire petroleum industry's 1961 earnings prospects will be undermined.

WHEN THE COLD WAVE drew down heating-oil stocks fast, refiners reacted impulsively by boosting runs way up. Some increase may have been in order, but not to the highest level in history.

They did shift yield patterns to make less gasoline and more distillate. But they got religion too late to assure salvation. If they had been making less gasoline during the past 6 months they could have taken the cold snap in stride and would be in no trouble now.

The present situation would not be serious if it were not for the foundation for trouble that the refiners laid last summer. Then, to the consternation of the entire industry, runs persisted at extremely high levels.

As a result, the motoring season ended with gasoline stocks far too high and distillate stocks rather on the high side. If — for some reason unfathomable to anyone else — refiners felt they should run so much crude, they should have shifted yields to have more of their finished stocks in distillate and less in gasoline.

Now refiners are in a hole. And like the frog in the deep mudhole, every time they climb up one foot they slip back two. To avoid the possibility of running tight on distillate they turn out far more gasoline than is needed at this season.

This surplus gasoline is going to plague them for months to come. It will depress the market and invite cut-price dumping. And it's a long time to the heavy motoring season.

WHAT TO DO IS OBVIOUS: Cut runs and plan to hold them down all during the spring period of low demand; and retain yield patterns that minimize gasoline output. Distillate stocks are still high enough to avoid any likelihood of a shortage to consumers.

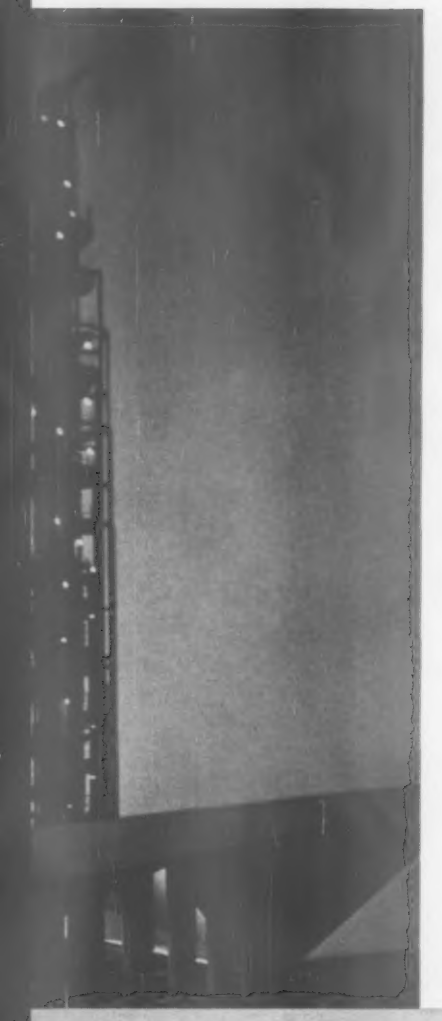
The opportunism that has governed refinery operations should be displaced by top-level, broad-gage planning. This means watching current statistics, developing trends, historical patterns, and seasonal fluctuations— and preparing for them months ahead.

If only refiners suffered for their foolishness, they could stew in their own juice and it would serve them right. But the condition of the gasoline market affects the financial health of the entire industry, which is why the whole industry is demanding that top management exercise firmer and wiser control over what refineries do.

Foxboro pneumatic control huge Canadian

THREE FOXBORO CONTROL PANELS for Imperial's Chemical Products Cracking Unit are housed in this unique hexagonally-shaped control room. Panels, which are arranged in a star-shaped pattern, contain 178 Consotrol recorders and controllers. Panels were built by The Foxboro Company, Limited, Montreal.

installed at Refinery and Petrochemical Plant



Imperial Oil's giant Sarnia Plant counts on Foxboro Consotrol* instruments for accurate, dependable control

From its star-shaped control room to its towering columns, they've used the most advanced refining techniques at Imperial Oil's 94,000 barrel-per-day refinery at Sarnia, Ontario.

Little wonder that accurate, dependable, low-maintenance Foxboro Consotrol instruments were installed. For example, clay treating, cracking and fractionation, ethylene recovery, butadiene extraction, refrigeration, light ends, Hydrofining, Powerforming, debutanizing, detergent alkylation, and production of Naptha Specialties — all operate under Foxboro control.

Actually, you'll find Foxboro small-case pneumatic consotrols serving leading refineries wherever reliable instrument performance is a must. If you're not familiar with the Consotrol story, ask your nearby Foxboro Field Engineer for full details. Or write for Bulletin 13-18. The Foxboro Company, 602 Neponset Avenue, Foxboro, Massachusetts.

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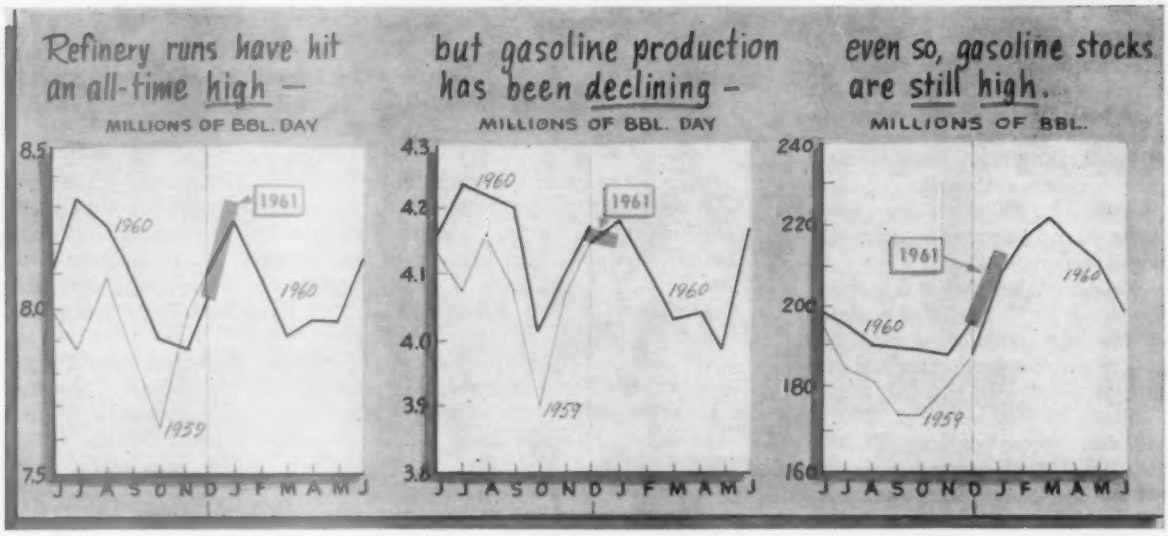


This means that, despite a shift in yields . . .

Refiners Aren't Out of the Woods, Yet

PITY the refiners. They can't win. They're doing exactly what they should, for a change, and still face the peril of market and price troubles this summer.

Refiners have stepped up runs to meet terrific winter demand for distillate heating fuels.

They have shifted yields to produce less gasoline, unwanted at this season of the year.

Yet gasoline stocks are mounting dangerously.

The confusing turn of events really is driving home two hard lessons for the refining segment of the industry. Refiners are discovering that a booming heating-oil business in the winter, although profitable, may sow the seeds for price troubles in gasoline the following summer. They also have learned that mistakes made one summer may hold over to haunt them the next.

Consider what is happening:

The industry set an all-time record for crude runs in January. Pressed by high demands for distillate fuels during the cold weather in December and January, refiners turned to the high runs in most areas to produce the material.

And let it be said in their behalf, refiners at the same time took advantage of their process flexibility.

They shifted yields away from gasoline toward heating oils, the product they needed most. The result was that gasoline production was held lower than the year before.

But refiners found to their dismay that gasoline stocks shot up anyway to burdensome levels. The same disagreeable weather that increased distillate demand for space heating depressed gasoline demand. Highway travel was curtailed, and autos cooling their tires in garages didn't burn any fuel.

Besides the drop in motoring, another factor aggravated gasoline stocks. They were too high at the start of winter because of abnormal runs and high yields last summer and early fall.

Climb in runs . . . The chart shows clearly the steep upward trend in refinery runs since last November.

From a low of 7,890,000 bbl. daily in November, runs averaged 8,020,000 bbl. in December and reached the all-time high of 8,320,000 bbl. daily in January.

January also included a week when runs topped 8,400,000 bbl. daily for the first time. That was the week ended January 27, which averaged 8,401,000 bbl.

The January average, however, was only slightly higher than the 8,307,000 bbl. daily averaged last July. That was the peak of abnormal refinery runs which persisted last year from June through October. These runs gave refiners a big backlog of gasoline going into the offseason for motoring.

The statistics show that refiners wisely shifted their yield pattern in January away from gasoline to heating oils. The high level of refinery runs was not turned into gasoline. Production of the motor fuel actually dropped below the average for December and was well

below the average for January 1960.

The actual January gasoline production was 4,160,000 bbl. daily compared with 4,184,000 bbl. daily for the same month in 1960. Gasoline stocks, however, reached 213,500,000 bbl. compared with 206,000,000 bbl. last year. In December they were 196,500,000 bbl. compared with 187,100,000 bbl. the year before.

Delayed reaction . . . It's easy to see on the charts that part of the explanation for the stock rise in face of lowered production is what happened last summer.

Refinery runs then were at extremely high levels for the season of the year. This resulted in excessive gasoline production and very little drawdown in gasoline stocks.

Stocks in May were 222,700,000 bbl. and dropped only to 188,700,000 bbl. in November before they started the usual winter accumulation.

The trouble, naturally, is that the current high level of stocks will get higher before the motoring season in late May really gives gasoline demand a good lift. Demand for distillates in space heating also will be tapering off.

In the presence of this demand picture, large stocks of gasoline could have a softening effect on gasoline prices. It will take close control on refinery runs and strong determination to offset the tendency of some refiners to convert excess gasoline stocks into cash by a cut-price sale.

Once this starts, it's difficult to stop. Experience also has shown if the industry starts the motoring season with its prices down, it takes weeks to restore stability, and much of the summer's profits is gone.

That's why refiners in the next 2 months hold the key to the 1961 profit pattern for the industry. Poor prices at the pump these days are felt all the way back to the well.

Refining activity last week gave encouraging evidence refiners may be aware of the gasoline danger. Runs averaged 8,405,000 bbl. daily for a new high, but gasoline output averaged 4,065,000 bbl. daily which was less than the week before when runs were lower.

Gasoline stocks reached 215,330,000 bbl. a gain for the week of less than a million barrels.

Texas Eases Off, Sets 10

• Railroad Commission surprises industry with a jump of roughly 200,000 bbl. daily in permissible flow. It makes the biggest monthly allowable in the past year.

THE TEXAS Railroad Commission took its feet off the brake last week in setting the crude-oil allowable for March.

Surprising both producers and purchasers, the commission fixed a 10-day producing pattern for March which will result in the highest Texas oil allowable since February 1960.

Commission member Ernest O. Thompson said the "careful stewardship" of the commission over a long period of time has enabled the Texas oil industry to work off its surplus inventory of crude and products.

He said the industry in Texas "seems to be first in line in leading the industry out of the depression."

Next month's allowable will be 2,980,842 bbl. daily. This is an increase of 176,365 bbl. daily for the initial allowable for February and a gain of 210,108 bbl. daily over that in effect February 4.

At this level, it will be the highest allowable since the 3,035,186 bbl. daily figure in effect February 27, 1960.

With the action, the commission apparently underscores warnings of its various members in recent months that Texas is tired of doing the nation's job of holding down production while oil from other states flows into Texas refineries.

Testimony favorable . . . Despite the size of the increase, however, purchasers' testimony indicates they are willing to boost the flow more.

Close questioning by the commissioners brought out that many major crude buyers would not have any oil for sale on a 10-day pattern.

And spokesmen for Humble Oil & Refining Co. indicated the firm would be willing to buy all surplus oil that would result from 10 day's production.

Humble has been hurting for

Hearing on Fuels-Policy Study Set

• Proposal calls for a broad study of prospective and current fuels by a committee of 16 representatives and senators. There's little chance it won't develop.

A COMPROMISE resolution calling for a joint congressional study of a national fuels policy will be given a public hearing in Washington Feb. 21.

The House rules committee set the date last week after Rep. Wayne Aspinal, (D.-Colo.), chairman of the House interior committee, revealed concessions have been made to both petroleum and consuming interests.

Major changes in the revised resolution point out:

. . . Encouraging the development of adequate energy supplies is in the national interest.

. . . Periodic review by Congress should be made of various governmental policies and laws that play a vital role in the development of the nation's energy resources.

. . . Changes in policies and laws may be necessary to coordinate and implement present practices into an effective national fuels policy. The original resolution declared a study was necessary to determine if a national fuels policy is needed.

. . . Interest of the consuming public lies in the availability in all regions of the country of an adequate supply of various fuels at reasonable prices.

Otherwise, the resolution still calls for a committee of eight House members and eight Senate members to hold hearings and make a report by April 1, 1963. Budget of $200,000 is provided for expenses.

The amendments actually give the proposed study a broader direction. The committee will study current and prospective fuel and

Days in March

TEXAS ALLOWABLE BY DISTRICTS

District	March	Ch. from Feb. 4
1. Southwest	53,955	+ 1,602
2. Gulf Coast	123,798	+ 10,781
3. Gulf Coast	364,375	+ 24,348
4. Southwest	205,472	+ 15,584
5. East Central	32,642	+ 1,917
6. Outside East Texas field	135,435	+ 10,883
6. East Texas field	144,445	+ 11,289
7-B. North Central	170,877	+ 9,136
7-C. West Central	141,272	+ 9,944
8. West Texas	1,208,004	+102,860
9. North Texas	626,112	+ 8,704
10. Panhandle	138,455	+ 3,060
Total	2,980,842	+210,108

crude for several months and has consistently pushed for higher allowables. At previous hearings, Humble has complained that it has not been able to buy the Texas crude it needs during the long string of 8 and 9-day producing months. And it has had to go out of the state to get crude.

for February 21

energy resources instead of just available fuel and reserves. The resolution also makes clear the aim of the study is to assure a plentiful supply of fuel for the nation and not merely the immediate health of the fuels industries.

The measure, originally pushed by coal interests and opposed by oil men, was blocked in committee last session. It got a new lease on life with election of President Kennedy whose platform called for a fuels policy. With more than 50 senators endorsing the study now, there appears little chance it will be sidetracked.

Against this background, many oil and gas representatives changed their opposition, decided to make the best of the deal and protect their interests by joining the study. They played a key role in winning revisions that may change the course and scope of the study.

watching WASHINGTON

Clyde La Motte

• Once over lightly: Area pricing, views on oil, etc. . . .

A QUICK CHECK around town by telephone reveals that:

. . . **Some FPC officials wonder** privately whether there is any point in holding hearings at this time on area-wide pricing.

Two new members will soon be on the commission and a third will move in in late June. They might decide to scrap the area-pricing approach. If so, prior hearings would simply waste everyone's time.

Remember that James M. Landis, appointed by the President to report on regulatory agencies, brushed off the area-pricing approach with the remark that it was "too late" to keep prices from rising.

. . . **API is still studying** ways to beef up further its Washington operation. One possibility: API President Frank Porter may spend much more time in Washington.

. . . **Rear Admiral Burton Biggs,** head of the Pentagon's Division of Petroleum Logistics, plans to retire this fall.

Don't believe rumors that he may take another government oil job or take a spot with some oil association. He won't.

. . . **Jobbers suspect** they will be included in proposed broadening of minimum-wage coverage, but they hope for exemption from overtime provisions.

. . . **Justice Department staffers** went over the records of the Military Petroleum Supply Agency with a fine-tooth comb for many months before writing their report. Conclusion: MPSA is doing a good job of buying oil.

The Justice Department investigators conceded, too, that they saw signs of brisk competition in the industry's efforts to sell products to the military.

. . . **Elmer Bennett,** former under secretary of Interior, is now a partner in a law firm in Washington.

He, too, saw plenty of competition in the industry. "The thing that seemed to worry most oil men who called on me was that oil-import rules would give a rival firm some competitive edge," Bennett recalls.

. . . **Frank Ikard,** a Texas congressman who keeps an interested eye on oil matters in Washington, thinks the industry was wise in saying publicly not long ago that it doesn't oppose an impartial fuels study.

He wishes, though, the move had been made much earlier. Figures it would have been more effective and would have put oil in a better position to help shape up such a study.

. . . **A West Virginia congressman** is proposing that natural-gas imports be taxed the same as liquid-oil imports.

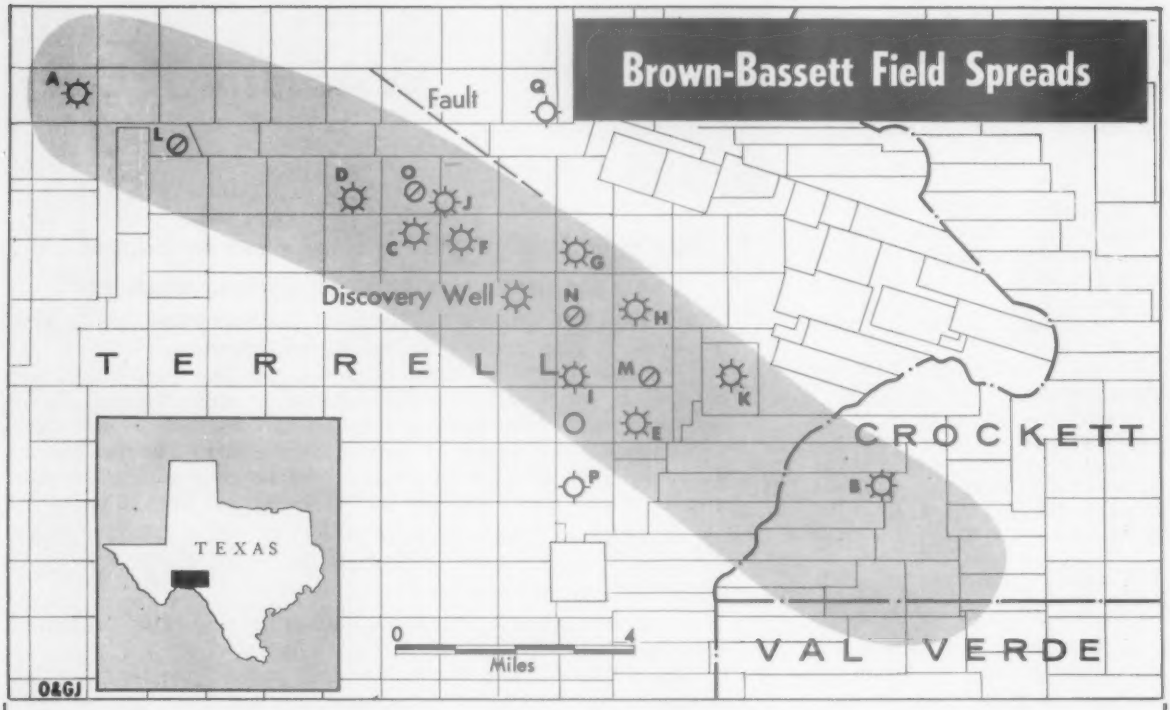
. . . **There may be more** centralization of government oil policy-making.

In the past, State Department has called some signals, Interior some, OCDM others, and so on.

Sometimes there were stalemates because of disagreements, so nothing was done.

If the centralization develops, look for Interior to emerge as the top dog on oil matters.

. . . **Decision at Interior** on whether to retain or replace present oil-import administrator and director of Office of Oil and Gas will probably be left up to Secretary Udall's new assistant secretary for minerals.



Completed Brown-Bassett Producers

Map Code	Well	Potential (M.c.f.)	
Disc.	Mobil 1 Brown-Bassett	Ellenburger	108,000
		Fusselman	75,000
A	Sinclair 1 Poulter	Ellenburger	3,000
		Wolfcamp	5,000
B	Sun 1 Mitchell	Ellenburger	4,300 (natural)
C	Conoco 1 Brown-Bassett	Ellenburger	28,750
		Fusselman	17,862
D	Shell 1 Turk-State	Ellenburger	70,000
E	Mobil 2 Banner Estate	Ellenburger	29,000
F	Mobil 1 Bassett-Goode	Ellenburger	76,000
G	Mobil 2 Bassett-Goode	Ellenburger	3,500
H	Mobil 2 Goode Estate	Ellenburger	2,900
I	Mobil 2 Brown-Bassett	Ellenburger	68,500
J	Richardson & Bass 1 Goode	Ellenburger	55,000
K	Mobil 1 Banner-Estate	Ellenburger	165,000
		Strawn (not yet potentialed)	

Drilling Wells

L Shell 1-A Turk
M Mobil 1 Hoge Banner
N Mobil 3 Brown-Bassett
O Sinclair 1 Scott

Dry Holes

P Mobil 1 State-Brown . . Abandoned 1959 at 12,638 ft. in Silurian.
Q Hunt 1 Cannon . . Drilled 1957 to 14,759 ft., never reached Devonian

West Texas Gas Field May Cover 50 Sections

Robert J. Enright
District Editor

THREE YEARS ago the 1 Brown-Bassett drilled by Mobil Oil Co. and Western Natural Gas Co. was termed by The Oil and Gas Journal as 1957's most significant West Texas discovery.

And in mid-1958, still with just one well officially completed, some predicted that Brown-Bassett could become West Texas' biggest gas field (OGJ, Aug. 18, 1958, p. 106).

The big Terrell County field seems now to have almost gained that title.

As of last week, operators had proved up its thick Ellenburger pay for a distance of at least 16 miles with an even dozen completions along the huge Pandale anticline. Four more wells are drilling.

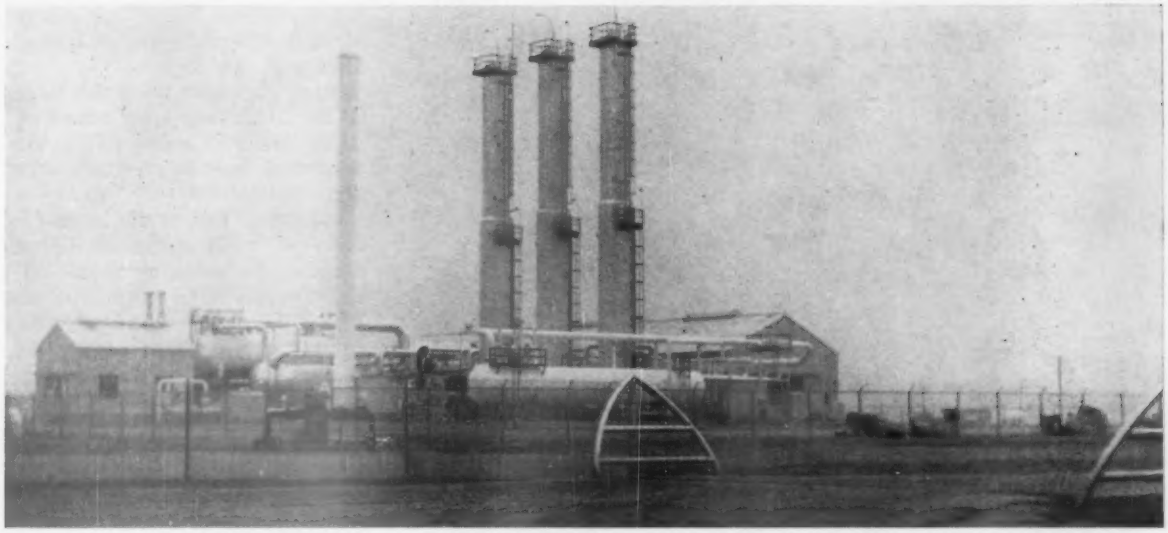
50 sections possible . . . With just one duster drilled to date, it's hard to say just how big the field will be when fully defined. But a producing area of 50 sections does not seem out of line and may be conservative.

Development now is on a northwest-southeast trend from Sinclair Oil & Gas Co.'s 1 Poulter (A on map) in Section 21 to Sun Oil Co.'s 1 Mitchell (B on map).

It's true there are a couple of large gaps in this stretch. The Sinclair well when completed recently was a 6-mile stepout to the west from the closest field producer, Continental Oil Co.'s 1 Brown-Bassett (C on map).

The 1 Poulter was regarded then by some as a new field discovery. Sinclair geologists, however, call it a Brown-Bassett extender. And so do geologists for Shell Oil Co. which holds the bulk of the acreage in this area of the play and has shot it extensively.

Since Sinclair completed its long stepout, Shell has brought in its 1 Turk-State (D on map) in Section



NEW PROCESS is used in El Paso Natural plant to extract CO_2 from Brown-Bassett gas. The gas is exposed to a mixture of solvents under high pressure which absorb the CO_2. The plant is 25 miles south of Sheffield.

8, Block R, TC Survey, as a 1¼-mile west extension from the Conoco well. And its 1-A Turk (L) in Section 9, GC&SF Survey is now drilling 3 miles farther to the west and only 2 miles southeast of the Sinclair 1 Poulter (A).

Successful completion of the 1-A Turk should resolve all doubt that this is still Brown-Bassett.

Sun, the discoverer? . . . To the southeast, in Mobil-Western territory, development makes it appear more and more certain that Sun's 1 Mitchell in Crockett County is also a Brown-Bassett well.

It's a good bet that this test, drilled way back in 1952-53, actually was the Ellenburger discovery for the entire Pandale structure.

The 1 Mitchell topped the Ellenburger at 13,750 ft. It drilled 1,208 ft. of the pay to 14,958 ft. before an impossible fishing job (lost drill collars) forced Sun to call a halt.

In subsequent tests, the well produced naturally 4,300,000 cu. ft. of Ellenburger gas daily on calculated absolute open-flow potential before it was shut in. This would be regarded as a fair natural-flow gage anywhere in the field. Most field wells have required acid treatment to bring them in big.

Only one dry hole . . . Only duster in the field to date was drilled by Mobil at its 1 State-Brown, which actually never reached the Ellenburger.

This extension try (P on map) was abandoned by Mobil in 1959 at 12,638 ft. in the Fusselman. Finding the Fusselman so low left virtually no hope, Mobil felt, for finding the Ellenburger productive. This well appears to prove a southern field boundary.

On the north, a tremendous 3,000-ft. fault is a definite field limit. It extends generally from southeast to northwest. Since no well has yet cut this fault, its exact route isn't clear. Some operators figure it running slightly more northerly than shown on the map, some more westerly. But all agree it's there.

A 1957 duster drilled by Hunt Oil Co. left no doubt. Hunt drilled its 1 Cannon (Q) only 2½ miles northeast of present Brown-Bassett production. It went to a total depth of 14,759 ft. and never reached the Devonian. Its log shows that the well ran consistently about 3,000 ft. lower than Mobil 1 Brown-Bassett.

Thus, present indications are that field width in the area of the Mobil 1 State-Brown is about 3 miles.

Figuring a 3-mile width from the Sinclair 1 Poulter to the Sun 1 Mitchell would give Brown-Bassett roughly 50 sections of productive Ellenburger.

Available evidence, based on contours on top of the Ellenburger, indicates production will not extend very far past the 1 Poulter to the northwest. But the situation is not so clear to the southeast.

Reserves mushrooming . . . Ellenburger potentials of Brown-Bassett wells completed to date have fluctuated drastically from a low of 2,900,000 cu. ft. daily at Mobil's 2 Goode Estate (H) to a high of 165,000,000 cu. ft. daily at the same operator's 1 Banner - State, being completed in Sec. 332, TW&NG Survey (K on map).

Two of the three poorest wells in the field—the 2 Goode Estate and Mobil's 2 Bassett-Goode (G) which potentialed only 3,500,000 cu. ft.—are located just 2 miles east and 1 mile north, respectively, of Mobil's prolific discovery.

These two wells appear to be in a sort of pocket area of low Ellenburger permeability and porosity.

Estimating Brown - Bassett reserves, thus, is difficult.

Mobil some weeks ago put field reserves of pipeline gas at about 800 billion cubic feet. Since Ellenburger gas in the field generally is half carbon dioxide, gross gas reserve under this estimate would be about 1.6 trillion cubic feet.

Mobil made its estimate, however, before potentialing its prolific 1 Banner-State. Even more important, its 9-well estimate did not take into account reserves added by Sinclair's long extension or the probability that Sun's 1 Mitchell also is in Brown-Bassett.

These three factors would add tremendously to reserves.

Drilling gaining . . . Drilling follow-

SHELL EXTENSION try is 3 miles west of main body of Ellenburger production in Brown-Bassett (L on map).

ing Mobil's strike flurried briefly with offsets by Richardson & Bass, Mobil, and Continental.

It then subsided with only Mobil active and that firm moving cautiously.

Reasons for the deliberate pace were many. The Pandale anticline is extensively faulted. An outlet for gas with so high a CO_2 content appeared distant. And Brown-Bassett wells are expensive. Even now, after considerable drilling experience and with gas-drilling cutting costs, field wells are costing close to half a million dollars.

Drilling picked up with El Paso Natural Gas Co.'s extension of its pipeline system to the field this winter and its completion of a plant there to process the gas.

Completion of Mobil's 1 Banner-State leaves four projects still active. These are: Shell's 1-A Turk (L), Sinclair's 1 Scott (O), and Mobil's 1 Hoge Banner (M), and 3 Brown-Bassett (N).

Odds are that a dozen or more Brown-Bassett wells will be drilled this year. Mobil likely will drill about eight of these—for the most part stepping out cautiously on a one-well-at-a-time basis.

The company's next planned location is the 1 Brown-Nelson, 1 mile north of its 1-State Brown dry hole (at P).

Puzzles a specialty . . . Potentially West Texas' biggest gas pool, Brown-Bassett probably is its most unusual too.

Apparently about the only thing a geologist can count on for sure is that a well will find a thick zone of Ellenburger with some gas in it which contains CO_2.

Gas production has been established also from three other pays—the Fusselman, Wolfcamp, and now Mobil's 1 Banner-State (K) has apparently proved commercial Strawn gas as well as its prolific Ellenburger flow. But production in these other zones is extremely spotty.

Mobil's discovery, for instance, potentialed 75,000,000 cu. ft. daily from the Fusselman, together with 108,000,000 from the Ellenburger. But the only well since to prove commercial in the Fusselman has been Conoco's 1 Brown-Bassett (C) 2 miles northwest with a potential of 17,862,000 cu. ft. daily.

All others found that zone too tight.

The upper portion of the Fusselman thins out going south and east across the structure and the entire section is missing in the vicinity of Sun's 1 Mitchell.

Sinclair's 1 Poulter at the other end of the field is the only well so far to find commercial Wolfcamp pay (Potential: 5,000,000 cu. ft. daily).

CO_2 content varies . . . Another interesting puzzle is that CO_2 content of the Ellenburger gas shows distinct variations between wells.

In most of the wells, it has made up 50-54% of total gas flow. But it has run well below that average in some others. In the 1 Banner-State it is only 39%.

Some geologists think this might be due to faulting. Some others feel stratification is more likely. But most find neither explanation entirely satisfactory.

Adding to this puzzle is the fact that the small quantities of gas found in the overlying Strawn lime and Connell sands (the latter just 100 ft. above the Ellenburger) are entirely free of CO_2.

The gravity of the gas in the Ellenburger also differs from well to well. And the gravity differences seem to correlate fairly well with the varying CO_2.

Corrosion seen as problem . . . As of last week, El Paso was taking 60,000,000 cu. ft. of gas from six wells in the field at its Brown-Bassett plant—all of it from the Ellenburger.

El Paso has contracts with Mobil and Continental to pay 16 cents an M.c.f. for Ellenburger gas after CO_2 is extracted. Fusselman producers are not yet connected to the plant. And it is believed that a separate gathering system will be necessary to take the Fusselman gas, which contains no CO_2.

Brown-Bassett operators will be doing some pioneering in the corrosion field in attempting to produce gas containing so much CO_2.

Operators in Puckett field in neighboring Pecos County have had some real headaches from CO_2 corrosion. And the CO_2 content in the gas there is much lower than at Brown-Bassett.

There are also traces of hydrogen-sulfide in the gas at Brown-Bassett.

In the absence of scientific answers, Mobil completed its first wells in the field using a variety of steels and with tubing coated internally with various plastics.

Last June, however, it joined with two affiliates and eight other operators in a joint program to study the corrosion problem.

At the end of this joint effort, Mobil carried out further tests on its own until January 31 this year.

Data gleaned from the tests indicate Brown-Bassett operators can greatly reduce corrosion by carefully selecting equipment and materials that go into the wells.

Sunray Ready for Octuple Completion

THE ONLY REASON the oil industry doesn't have an octuple completion today is that the pay sands in McFaddin field of South Texas failed to cooperate.

Sunray Mid-Continent Oil Co. has designed, and Oil Center Tool Co. has built, a wellhead assembly capable of producing through four dual strings from eight sands.

The christmas tree has been installed, and the well has been finaled for production from five sands—three gas and two oil.

That makes it technically one of the industry's rare quintuple completions. But it still is less than Sunray Mid-Continent's two sextuples in the same general area.

The wellhead assembly and completion technique is the same as the one used in the company's first sextuple last may (OGJ, May 23, 1960, p. 66), except that it was built to handle four dual strings instead of three.

Instead of getting eight gas pays, the operators found two oil sands and three gas sands.

Here is how the well was finaled:

One string is a dual gas producer from 5,138-43 ft. and 5,530-34 ft.; another is a single gas producer from 5,277-80 ft.; and the other two are single oil producers from 5,640-44 ft. and 6,360-64 ft.

The dual string consists of 2½-in. tubing containing another string of 1¼-in. tubing.

The other three are 2½-in. tubing. The inside strings of 1¼-in. tubing were not installed because the operators feared a sanding problem would arise in producing oil instead of gas through the small-diameter tubing.

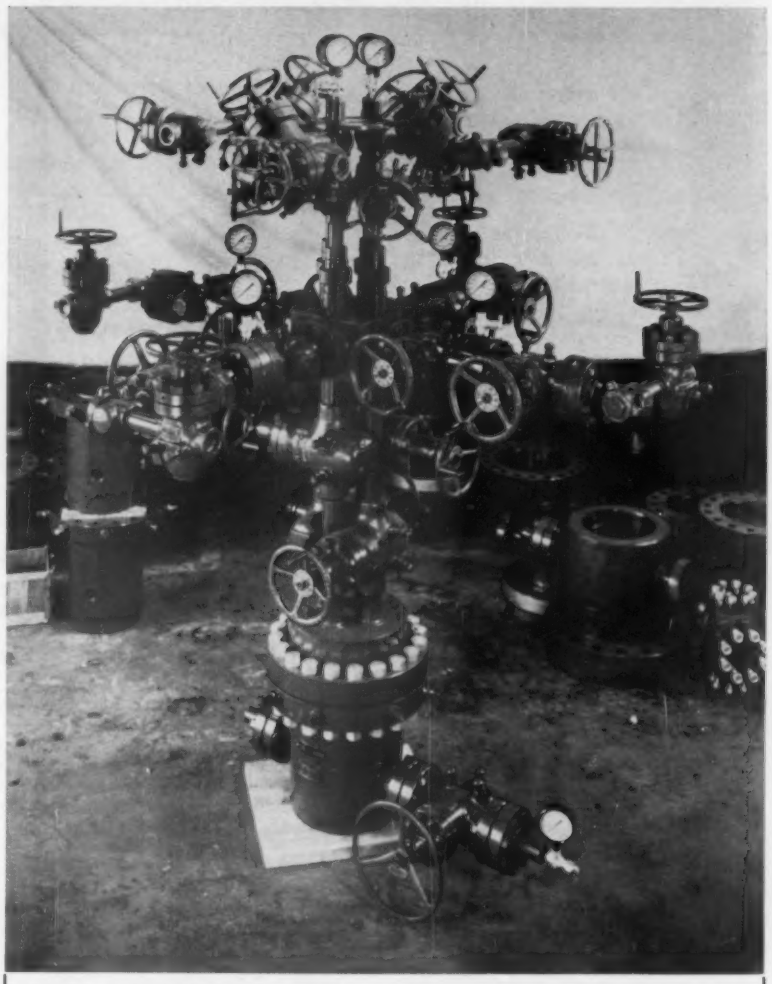
Until the well gets an allowable from the Texas Railroad Commission, it will produce from only one of the oil strings.

The well is the McFaddin E-21 in Victoria County's McFaddin field. In the same field is one of Sunray Mid-Continent's two sextuple completions, the McFaddin E-20. The original sextuple is in the North LaWard field of adjacent Jackson County.

Like those in the two sextuples, the 2½-in. strings in the E-21 were cemented side by side in the open hole. However, because there were four strings instead of three, the surface casing was 10¾-in. instead of 9⅝-in.

What's ahead . . . Sunray Mid-Continent has no plans at the moment for an octuple completion, although it is certain that one could be accomplished under proper conditions.

In fact, company engineers don't see why—mechanically—there can't be multiple completions in excess of octuples.



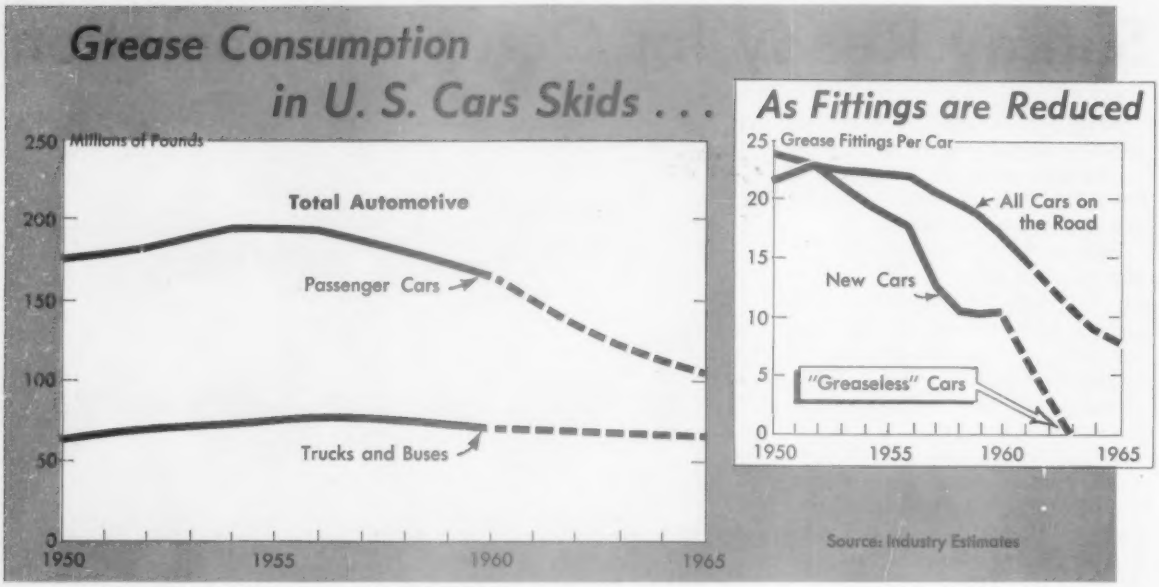
You Need This Kind of Tree for Octuples

THIS CHRISTMAS TREE was built for a wellhead assembly capable of producing from eight sands through four dual strings.

The manufacturer, Oil Center Tool Co., constructed the tree for the designer, Sunray Mid-Continent Oil Co., around standard components used for other multiple completions.

Oil Center Tool used its C18 casing head, fitted with a free-floating flange that requires no aligning pins. A quadruple master bushing supports threaded hangers for 2½-in. tubing. Four small tubing heads are installed to support 1¼-in. strings if needed.

Operators can run centralizers and other tools through hangers of the wellhead without difficulty.



New Threat to Lubes—the "Greaseless Car"

• Some look for the greaseless car to dominate the auto industry in just 2 years, but much depends on success of pioneer models. Lubes, already pinched by trend toward fewer grease fittings, may feel a tighter squeeze.

Gene T. Kinney
East Coast Editor

THE ELIMINATION of grease fittings on U. S. passenger cars may come as early as 1963.

That's the year many in the oil industry and in Detroit believe will mark the adoption of the "greaseless" car by most, if not all, auto companies.

It is also the year which could see the beginning of an even steeper drop in automotive-grease consumption.

Demand for auto lubes has been declining for years as manufacturers reduced the number of conventional grease fittings in cars. The 1950 models had an average of 24 fittings compared with today's average of 8.

This reduction cut deeply into the use of lubes, of course. And the prospect of all-out production of greaseless cars raises the threat of a long-drawn-out nose dive in lube sales.

Whether the current trend to eliminate all grease fittings will be accelerated depends a great deal on the performance of greaseless pioneers. If they meet with little complaint, a stampede is expected. The manufacturer who can offer a trouble-free greaseless car will enjoy a sales advantage that other makers cannot long tolerate.

Actually, the term "greaseless" is a misnomer. It is being applied to the car which doesn't require frequent greasing of suspension and steering-linkage bearings. The 1961 pioneers are Cadillac, Ford, Lincoln, and Mercury.

These cars are pre-lubed at the factory with a molybdenum disulfide-base grease which is advertised as being good for 30,000 miles, or 3 years of normal driving. Bearings are sealed with plastic and rubber, and cars must be returned to the dealer for removal of fitting plugs and for greasing with a special gun.

Grease-consumption impact . . . Since new cars make up only about 10% of the total fleet on the road, the immediate reduction in automotive-grease consumption will not be so drastic.

But it will be substantial, nonetheless.

Various oil-company estimates place total consumption in 1965 at 80 to 90 million pounds below the record year of 1956, when almost 200 million pounds were sold. About 50 million pounds of the reduction will be attributable to the fewer number of fittings.

In the passenger-car market alone, consumption is expected to decline from 120 million pounds annually to about 40 million pounds. These estimates are based on several assumptions:

. . . The virtual elimination of chassis fittings on passenger cars in 1963.

. . . A somewhat slower rate of increase in vehicle registrations.

. . . A constant annual-use rate for passenger cars (9,700 miles), for trucks (10,800 miles), and for buses (18,000 miles).

. . . A continuation of greasing-interval trends. Trucks and bus lube intervals have remained constant at around 1,000 miles; passenger-car lube intervals have increased from about 1,700 miles since the end of World War II to 2,500 miles because of less-frequent motor-oil changes.

Recent advances . . . The lube-free

Kelly Named to High Interior Post

FOR THE FIRST time in many years, an oil man is about to take a high position in the Interior Department.

He is John M. Kelly, 46, of Roswell, N. M., president of Elk Oil Co., Inc., an independent producer of oil and gas (OGJ, Feb. 6, p. 77). President Kennedy said last week he intends to name Kelly assistant secretary for mineral resources.

Under Kelly will be the Office of Oil and Gas, the Oil Import Administration, the Bureau of Mines, Geological Survey, Office of Mineral Exploration, Office of Mineral Mobilization, Office of Coal Research and the Office of Geography.

The job pays $20,000 a year and is subject to confirmation by the Senate.

chassis has long been a goal of automotive engineers.

The savings of perhaps $50 throughout the life of a car are relatively small. But add the convenience of less servicing and benefits in ride and handling, and you have potent sales points.

The industry has been testing nonlubricated or "frictionless" bearings for several years. One of the more interesting tests was conducted with six 1958 model taxicabs fitted with a new type of ball-joint suspension bearing and steering-linkage bearing.

The bearings were lined with a Teflon fluorocarbon fiber described as being slicker than ice. It could withstand heavy static loads (60,000 psi.) and high temperatures (400° F.) without damage.

From October 1958 to June 1959, the taxicabs with the fiber-lined bearings ran 50,000 miles without chassis lubrication. During the same period, control cabs with conventional bearings had to be greased 36 times each.

Drivers of the cabs with experimental bearing linings were impressed by the better ride and handling. They called the effect of the friction-free bearings "the poor man's power steering."

The large Oldsmobile for 1961 cut the number of grease fittings from 12 to 4 and a new durable thermoplastic called Delrin was installed in the steering linkage, one of the most difficult barriers to the greaseless car.

Sealed prelubricated metal bearings and nylon bushings have been the means of reducing fittings on other Ford, General Motors, and American Motors cars this year. However, one maker has backed off from sealed bearings, replacing plugs with grease fittings for the time being.

Timetable altered . . . Three years ago the consensus in the auto industry was that the greaseless car would be standard in 1961.

Those who were not so bullish fixed the greaseless model year at 1963 to 1965.

The target has been altered, but not much. Opinion has shifted to the 1963-65 period forecast earlier by the conservatives. And there are still some who hold that the auto industry is over-optimistic about solving current and future problems.

One oil-company forecaster expects a period of watchful waiting, perhaps even of retrenchment, before the arrival of the truly greaseless car. He points out that makers of the new compacts showed no inclination to eliminate grease fittings.

He is the exception, however.

A word of caution . . . Automotive engineers with the oil companies warn of impending trouble if longer lube intervals become an excuse for neglect of routine service inspections.

They point out:

Although the lube interval has been extended to 30,000 miles on some cars, this does not mean that body hardware, universal joints, generators, and accessories don't need the usual regular attention.

If the motorist does not practice low-mileage (1,000-4,000 miles) inspections, his car is vulnerable to expensive mechanical failures which could have been anticipated and prevented.

New Resid-Import Study Set

• Udall will take a close look at entire resid program and make his own decision on handling of allocations.

ONCE AGAIN, the import program for residual fuel oil is due for a top-level review.

Interior Secretary Stewart L. Udall said he is reviewing "the entire program," including the allocation system which his predecessor, Fred A. Seaton, ordered in mid-January.

Udall set a public hearing for February 20. He said persons wishing to testify should notify the Oil Import Administrator.

"It is our intention to complete a thorough review and to make our own determination as to the proper system for allocations of residual fuel oil well in advance of the April allocation period," Udall said.

Udall, himself, will preside "most of the day," he said.

And, he indicated the hearing would be wide open in its range.

Udall also suspended a Seaton deadline of February 13 for residual importers to apply for the next period's quotas.

The Seaton changes, which followed a White House proclamation changing the residual rules to allow imports on the basis of "terminal inputs" as well as "history," have been widely attacked by persons in and out of the oil industry.

While the changes mean little revision in the over-all totals of residual imports allowed, they do call for a different division of the pie.

The National Oil Jobbers Council complains that the changes give jobbers only "crumbs" while benefiting chiefly a few large oil companies.

New England senators may use the Udall-ordered hearing to plead for the end of the residual import program—or at least for larger resid totals.

And coal industry forces may urge that residual import totals be cut further.

ON A CLEAR DAY, the Los Angeles civic center looks like this, but when an inversion layer of warm air . . .

Smog Forecast: Here Today, Gone by '65

- California is expected to approve its first afterburners sometime late this year. This means 1963 model cars will be equipped with afterburners and all cars in state will come under controls by 1965.

Carl Lawrence
West Coast Editor

CALIFORNIA has shifted into high gear in its auto-exhaust-control program, a plan which should rid Los Angeles of its title of "Smog Capital of the World."

The city still has 3, or possibly 4, years left in its reign as the smoggiest spot on the globe. But many who have followed the long, expensive fight to conquer smog feel the end is near.

The Air Pollution Foundation, organized in 1953 to find the cause of southern California's smog problem, and a solution, summed up the outlook this way when it announced recently it is closing its doors this spring:

"Inasmuch as we know that motor-vehicle exhaust is the sole remaining source of smog in Los Angeles, and the State of California has now embarked upon its control, the end of the 20-year smog siege is now in sight."

Charged with developing the auto-exhaust-control program is the California Motor Vehicle Pollution Control Board, a 13-member group appointed by Gov. Edmund G. Brown last spring.

Donald A. Jensen, executive director of the board, has moved swiftly in rounding out some of the final details of the board's control program. Jensen, 45, was chief administrative officer of Marin County in northern California before moving to Los Angeles with the control board.

"Our goal is certainly to get these things (exhaust-control devices) approved this year," Jensen says.

The MVPCB hopes to certify the first afterburners by October. Only two need be certified, but the board hopes to approve several before the year is out.

Once the burners are approved, there is a year's waiting period from the following January 1 before the law goes into effect. If two are approved this year, this will be the timetable for installing burners:

. . . **All cars sold** in the state after January 1, 1963, will be required to have afterburners. Both new and used cars which change title are covered.

. . . **All commercial vehicles** will come under the law from 1964 on.

. . . **All cars will be covered** after January 1, 1965—or in a little less than 4 years. Should the board fail to approve two burners this year—and this seems unlikely—the schedule would move back a year.

The law carries a county option on used cars, but the county must prove there is no air pollution problem. Too, all new cars sold in the state are excluded from the county option and must be equipped with burners once the timetable goes into effect.

A control program for blowby devices which will control hydrocarbons vented from crankcases also is expected to go into effect along with the exhaust plan. The MVPCB is scheduled to outline standards for these devices in March.

Crankcase leaks, caused by unburned gas escaping between pistons and rings and by oil vapors, account for one-fourth to one-third of the total emissions from automobiles. American-made 1961 cars being delivered in California come equipped with blowby devices, so this phase of the smog problem is already a reality.

. . . clamps a lid on the ground atmosphere, the city's notorious smog blurs the scene.

The problems . . . While the MVPCB has set up some standards, there are still some major problems to be overcome.

The biggest problem is fixing a price on the afterburners. There is no doubt burners are available which will meet the standards for controlling exhaust—but turning these out at a retail price set by the state is another problem.

In setting the price, Jensen says the state will take a hard look at all the proposed devices and come up with a figure based on a cost per mile to the motorist. Some manufacturers are offering afterburners for a set period of time; others are claiming theirs will last the life of the car. The units with the low cost per mile will no doubt have the edge over the others.

Jensen says the board must also make the ground rules for odor, noise, ease of inspection, service life, and similar aspects.

A set of recommendations covering these aspects is expected to be ironed out at the March meeting of the board. Public hearings will be held before the standards are adopted. Jensen is shooting for final approval in April or May.

Adopting these standards will not delay the board's program of testing devices to see if they control exhaust. The state's smog law requires that an afterburner reduce hydrocarbon emissions by 80% and carbon monoxide emissions by 60%.

Testing program . . . Jensen's office is ready to start testing devices as soon as manufacturers get the needed engineering information to his office.

Jensen says 140 firms and individuals have told the MVPCB they have afterburners to offer California motorists. Each applicant has been contacted and told what to submit with their applications.

As the manufacturer's information reaches the MVPCB, it will be checked out by the engineering staff. If a device passes the staff's inspection, the manufacturer will be asked to provide 25 prototypes for road testing.

Applications are just beginning to reach Jensen's office. He expects "most major inventors" to have their applications in by the end of the month and plans to start testing prototypes by April 1. The prototypes will receive a 20,000-mile road test to determine if they pass the final hurdle before being approved by the state.

The large variety of cars on the road today have been broken down into five classifications. Each afterburner manufacturer is to specify which classification his unit will fit and to give additional information on how the device can be adapted to the other models.

Jensen has mailed out 140 application blanks, but returns aren't expected to exceed 30 or 40%. He points out many of the inventors are individuals who have not made the concerted effort some companies have to develop an afterburner.

Most automobile manufacturers have developed an afterburner, or have connections among some 30 manufacturers who are considered leading developers of the devices.

Effect on oil . . . There is a slim chance the afterburner program will save refiners some money, but it looks as if the program is coming too late to do too much good (see p. 105 for refiners' fight on pollution).

One regulation refiners are fighting is Los Angeles County's Air Pollution Control District Rule 63, which says the olefin content of gasoline must be kept to 15%. Olefin content is measured in bromine numbers and 30 is the limit.

The APCD claims that olefins in gasoline mean olefins in the exhaust. Oil companies argue this is not the case. They say the olefins cannot be traced to the fuel's composition, but rather to the automobile engine—a mobile "cracking plant" which makes olefinic exhaust from nonolefinic gasoline.

Rule 63 has forced refiners to spend millions in recent months to add downstream processing which will keep the olefin content of gasoline within the law. And they face additional spending if the bromine number is lowered to 20 as scheduled in July 1962.

Afterburners would eliminate the need for Rule 63, since they would

King-Size Market for Afterburners

AFTERBURNER manufacturers who get approval to sell their product in California will be offering an auto accessory in one of the world's biggest car markets.

Auto registration in Los Angeles County alone totaled 2,772,523 at the first of the year. This would be an initial market in Los Angeles of $138.6 million based on a $50 price tag. And southern California is still growing.

At least 140 inventors claim they have developed an afterburner which will take the smog-causing elements out of auto exhaust.

Some Major Inventors of Afterburners

Manufacturer—	Type of Afterburner: Direct Flame	Type of Afterburner: Catalytic
American Cyanamid Co., New York		X
American Thermocatalytic Corp., Mineola, N. Y.		X
Arvin Industries, Columbus, Ind.		X
Chemetron Corp., Louisville, Ky.		X
Du Pont, Wilmington, Del.		X
Engelhard Industries, Newark		X
Ethyl Corp., Detroit		X
Hallett Manufacturing Co., Los Angeles		X
Harshaw Chemical Co., Cleveland		X
Holly Carburetor, Detroit	X	
McAlester Aircraft, Los Angeles	X	
Minnesota Mining & Mfg. Co., St. Paul	X	X
Monoxite Pantext Corp., Stamford, Conn.	X	
Monsanto Chemical Corp., St. Louis		X
Morris, Charles W., Los Angeles	X	
Norris-Thermador Corp., Los Angeles	X	X
Oxy-Catalyst, Inc. (Houdry), Wayne, Pa.		X
Technical Industries, Inc., Pasadena, Calif.		X
Thompson Ramo Wooldridge, Inc., Los Angeles	X	
Union Carbide Development Co., New York	X	X
Universal Oil Products Co., Des Plaines, Ill.		X
Wolverine Tube Div., Calumet & Hecla, Inc., Allen Park, Mich.		X

control the olefins in auto exhaust. To avoid the additional spending, the industry will have to sell APCD on this theory, and get the district to delay lowering the bromine number to 20.

If this is done, refiners stand to save an estimated $40 million—the price tag placed on the facilities needed to meet the 20-bromine requirement.

TEL may be curbed . . . Los Angeles smog officials may seek regulations which would outlaw the use of tetraethyl lead or tetramethyl lead in gasoline.

Air pollution control officer S. Smith Griswold says leaded gasoline is dangerous for two reasons: There are indications that the exhaust from leaded gasoline is unhealthful, and the lead coats catalysts which some manufacturers plan to use in afterburners to control auto exhaust—making them ineffective.

Griswold has no timetable on when he will seek a rule to prohibit the use of lead in gasolines, but plans to make further studies. Any proposal will have to be approved by the county's board of supervisors before it becomes a law.

Griswold also says he hopes to get a rule to limit the amount of oxides of nitrogen going into the atmosphere. This rule would have effects on the oil industry—both at refineries and in regard to the amount of oxides of nitrogen emitted in exhaust fumes from automobiles.

Motorist attitudes . . . As a result of the auto-exhaust-control program, oil companies will be getting California's motorists as allies in their fight against smog. But the new allies may turn out to be very suspicious and unfriendly.

As one smog expert points out, the normal reaction of the motorist who buys an afterburner will be that he wouldn't need to spend money for such a device if oil companies made gasolines which didn't cause smog.

If the average motorist does adopt this attitude, oil will have a public-relations problem.

Gulf's Earnings Jump to Record High

GULF Oil Corp. has joined the ranks of integrated oil companies recording the highest income in their history.

Gulf reported net 1960 earnings of about $330 million, a 14% increase over the $290 million earned in 1959. Per share earnings were $3.20 in 1960 compared with $2.82 the year before.

President E. D. Brockett reported the profits improvement resulted from operational gains in the United States. Gulf's net in U. S. operations increased from $78 million in 1958 to $152 million in 1959 and $197 million last year. Back of this sharp gain were increased domestic production of oil and gas, greater petrochemical sales, and increased efficiency.

Earnings reports from other companies include:

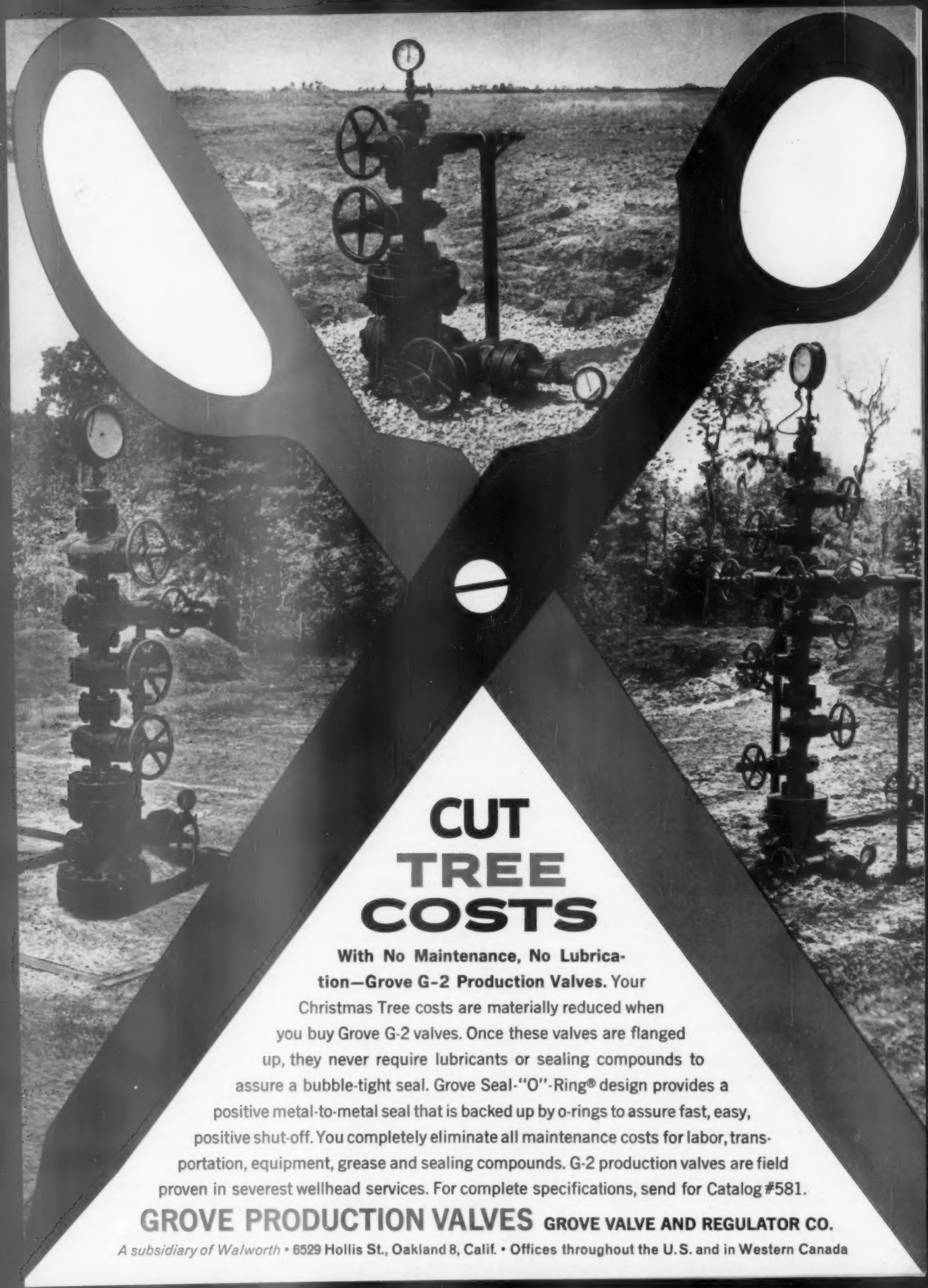
Tidewater—$35 million net or $2.22 per share in 1960, up from $33.9 million or $2.13 per share.

Ohio Standard — $24.6 million net or $4.94 per share, off from $24 million or $5.02 per share in 1959.

Sunray Mid - Continent — $41.1 million net or $2.10 per share in 1960—off from $43.8 million or $2.25 per share in 1959.

Kentucky Standard—$13.7 million net or $5.29 per share in 1960, off from $14.7 million in 1959.

British American—$30.8 million net or $1.51 per share in 1960, up from $25.6 million or $1.25 per share in 1959.



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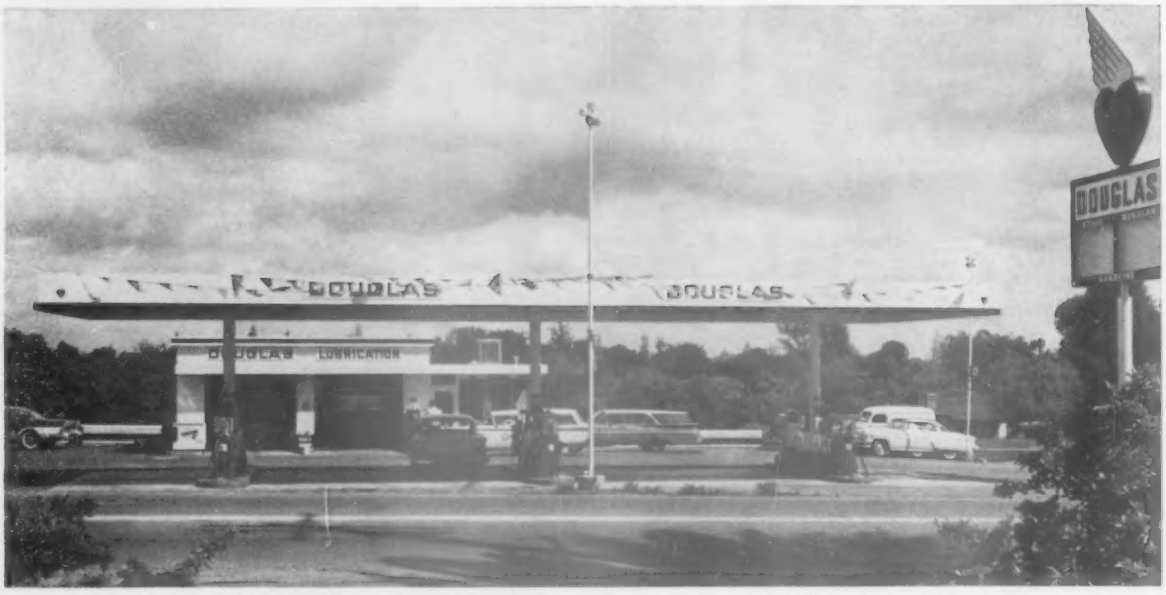


THE "FLYING HEART" stations of Douglas Oil will come under the Red Triangle now that . . .

Continental-Douglas Merger Approved

- Directors of two companies make a $17.9-million deal that puts Continental in California's gasoline market with a chain of about 270 retail outlets.

PLANS for merging Douglas Oil Co. of California into Continental Oil Co. were completed last week, ending months of speculation over who would acquire the independent California company.

Humble Oil & Refining Co. and Standard Oil Co. (Ind.) also talked merger with Douglas, but the field narrowed to Humble and Continental soon after the first of the year (OGJ Newsletter, Jan. 30).

The three major companies were interested in Douglas for the same reason—a chance to expand into retail marketing in California. Douglas is an integrated company, but its chain of more than 270 service stations is its biggest asset.

The Douglas merger will put Continental in the California retail picture for the first time. Conoco has production — but no marketing—in California.

The company currently markets in 28 states. About 8,500 outlets use the Conoco brand.

Conoco owns seven refineries with a capacity of 293,200 bbl. daily.

Crude production last year reached 156,274 bbl. daily, plus another 29,401 bbl. daily as equity in nonconsolidated affiliates.

Earnings for 1960 are estimated at $61.2 million, highest in the company's history. The earnings were 1.6% higher than in 1959.

Conoco is offering one share of stock for five shares of Douglas. Douglas has 1,240,426 shares outstanding, but this total will hit 1,570,000 if all conversions and options are exercised.

Based on last Wednesday's closing stock market figures, Continental's offer totals $17,976,000 figured at 1,570,000 shares of Douglas. Continental closed Wednesday at $57.25 and Douglas at $10.75.

After both boards approved the purchase, Conoco announced it plans to continue Douglas' operations under the present management and retain Douglas' "Flying Heart" brand name.

A new Douglas company is scheduled to be set up as a subsidiary of Continental, with four board members coming from the Douglas organization and three from Continental.

Now the merger goes to stockholders for approval. It still faces clearance by the Justice Department's antitrust division.

Douglas' assets . . . Retail marketing has been Douglas' strong suit in recent years.

In addition to building new stations—60 are in the works for the fiscal year ending March 31—the

INDUSTRY

Taxes on gasoline and diesel oil in Pennsylvania are going up 2 cents a gallon to 7 cents April 1. The increase, designed to produce an additional $74 million a year in highway funds, has cleared the legislature and been signed by Governor David Lawrence.

Sinclair Research, Inc., is planning a new production-research center in Tulsa which would double the scope of its activities in 5 years. Sinclair Oil & Gas has asked for special zoning of a 28-acre tract, which it proposes to transfer to Sinclair Research for the center. Pres-

company has renovated many older stations into first-class retail outlets. The company markets as an independent and sells three grades of gasoline.

During the year ending March 31, 1960, Douglas gasoline sales increased 33% over the previous year, hitting 75 million gallons. The company's total products sales have increased from 4,514,556 bbl. in 1951 to 7,242,339 in 1960.

Douglas owns three refineries with a combined capacity of 19,300 bbl. daily. These include an 8,800-bbl. plant at Bakersfield, a 7,000-bbl. plant at Clearwater, and a 3,500-bbl. plant at Santa Maria.

An intangible, but very real, asset is an import quota of approximately 8,000 bbl. daily based on the three refineries. This will be a net gain of an import quota for Continental since it has no other refineries in District 5.

Continental, through a partly owned subsidiary, San Jacinto Petroleum Corp., has been Douglas' major source of imported crude. San Jacinto has a 15-year contract to supply Douglas with Lake Maracaibo crude.

Douglas' crude production is running just under 2,000 bbl. daily. The company owns an interest in 173 wells in 16 California fields. Continental produces about 7,600 bbl. daily from 242 wells in California.

Honolulu next? . . . While the Continental-Douglas merger looks settled, another deal is imminent—the sale of Honolulu Oil Corp. of San Francisco. Company officials put Honolulu on the sales block several months ago.

Bidding for Honolulu closed last week. The company declined to identify prospective bidders, but there is no doubt many firms are interested in buying the company.

Unlike some of the other deals involving the sale of a West Coast property, many California companies are interested in buying Honolulu. Standard Oil Co. of California and Tidewater Oil Co. are among those considered prospective bidders. And it is reported a three-company combine composed of Union Oil Co., Superior Oil Co., and Ohio Oil Co. submitted a bid.

A Honolulu official said it may be several weeks before a successful bidder is announced.

The official pointed out the bids are irrevocable for 90 days—indicating it may be that long before the buyer is announced.

Gas Chromatography Adopted

. . . by California Natural Gasoline Association to determine propanes, butanes, and pentanes-plus in gas stream.

THE FIRST step in what may lead to a nation-wide standard of using gas chromatography to measure liquids in natural gas has been taken by the California Natural Gasoline Association.

CNGA recently adopted a standard test method of using chromatography to determine the propanes, butanes, and pentanes-plus in a gas-liquids stream.

In adopting the standard, CNGA points out the gas chromatographic method is considered equal to the long-standing charcoal method of determining the liquid breakdown of a natural-gas stream. The new method generally is considered quicker and more accurate than the charcoal method.

CNGA's plans include development of a fundamental analysis by gas chromatography which will measure the full range of gas liquids. The Natural Gasoline Association of America also is working on a fundamental analysis.

West Coast operators are expected to start writing the chromatographic method into their new processing contracts, now that the standard has been adopted by CNGA. Some contracts specify any "generally accepted method" of testing may be used, thus giving the operator the option to replace the charcoal method.

However, the association's action is not expected to see an end to charcoal testing. CNGA does not write specifications, but merely offers test standards to the industry.

BRIEFS . . .

ent laboratories are on a 7-acre tract which before 1952 was used for warehouse and shop facilities. Sinclair Research now employs 150 persons but plans to double the number within 5 years.

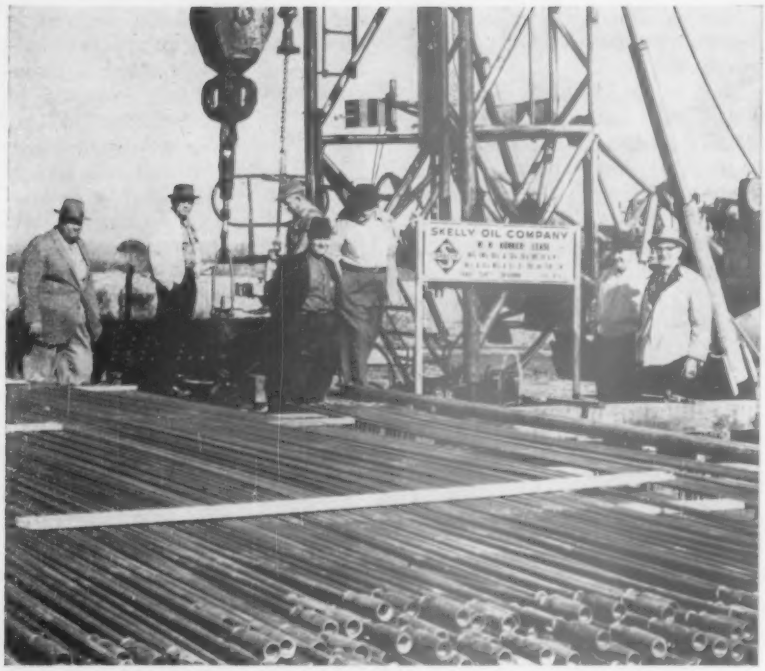
Purchase of 100 oil and gas wells and other properties formerly owned by Tex-Harvey Oil Co. has been announced by Expando Production Co., Wichita Falls, Tex., and B. Baldridge of Pampa, Tex. Production is from the Nacotoch and Pecan Gap sands. Nearly all of the currently developed leases are being water flooded.

Sale of half the stock in Dunne-Gardner Drilling Co., Inc., Wichita, Kans., to Kansas-Nebraska Natural Gas Co., Hastings, Neb., has been announced. Dunne - Gardner will continue its drilling and production program in Kansas and North Texas.

A Montana water flood has been proposed for the northwest portion of the Cut Bank field, Glacier County. Humble would operate the project, starting with 600 acres in the south part of the area and expanding the work later to include 2,700 acres. Currently, 62 Cut Bank sand wells average less than 4 bbl. daily per well.

Movement of research projects on the properties of hydrocarbon and other chemical compounds from Carnegie Institute of Technology to Texas A & M is planned by the project sponsors, the API and the Manufacturing Chemists' Assn. The new research center is scheduled to be set up about April 1.

A Canadian base of operations has been established by Apache Corp., Minneapolis, through acquisition of Woods Petroleum of Canada, Ltd. The deal included Woods' 30,000 acres of leases in Saskatchewan and Alberta, with production in the Garrington, Thompson Lake, and Mintlaw areas of Alberta.



Long Sucker Rod String Runs 13,800 ft.

SKELLY OIL CO. has completed an Oklahoma well that is believed to be the deepest ever produced in the Mid-Continent area with a sucker-rod pump.

A 13,800-ft. tapered string of sucker rods was run in Skelly's Bonner No. 6, Grady County.

Originally completed in May 1958, the well has production from the Springer sand at 10,030-62 ft., and from the first and second Bromide sands (Upper Simpson) at 13,856-14,026 ft. It is now pumping with production mingled from two zones.

In the photo, representatives of Skelly, Axelson-Garrett Division of U. S. Industries, Inc., and Jones & Laughlin Supply Division inspect the well.

The tapered Axelson sucker-rod string includes 2,800 ft. of 1-in., 3,000 ft. of ⅞-in., and 8,000 ft. of ¾-in. rods. The sucker rods were sold by Jones & Laughlin.

New System Helps Blending

• Electronic in-line method provides more accurate flow-rate control in petrochemical operations.

A NEW electronic in-line blending system which eliminates problems associated with flow-rate control will soon be installed in a Southwest petrochemical plant.

Highly accurate turbine meters will provide the flow measurement. These will feed pulses into electronic components which "remember" the total amounts of each component to be put into the blend, and regulate control valves so the desired ratios are maintained.

Control is based on instantaneous total quantity ratios, rather than instantaneous flow-rate ratios.

Since each component stream is controlled on the basis of instantaneous deviation from the required total quantity of the stream, over-all accuracy of a blend is limited by accuracy of the turbine flow meters.

Any control-loop errors become insignificant when compared to volume metered. Accuracy of each stream is within ±0.5%.

Developed by Fischer & Porter Co., Hatboro, Pa., the petrochemical plant system will be a two-component unit.

First refinery application will be a 12-component system, to be installed about mid-May.

Basic system . . . Where two components are to be continuously blended, total quantity of one stream is kept constantly in ratio with the total quantity of the other by:

. . . A turbine flowmeter in each line, developing a pulse signal of a frequency proportional to the flow rate in its line.

. . . A ratio setter which the operator sets to determine the ratio of main stream to component stream.

. . . A digital comparator which receives pulses from the ratio setter and the main stream. The comparator includes a field-adjustable alarm device to actuate an alarm signal if the count difference should go beyond the set acceptable limits (high or low).

. . . An electronic controller that receives the "process" signal from the comparator and develops a milliamp control signal for operation of the valve.

. . . A component-stream control valve. Its electro - pneumatic positioner converts the controller signal into a proportional pressure to position the valve.

Multicomponent systems . . . In multicomponent systems, all streams are referenced to a common, field-adjustable pulse source. Working from a fixed frequency oscillator, a total-blend rate setter develops a modified frequency that represents a common reference for all streams.

Desired total-blend flow rate is set directly to the total-blend rate setter. The resultant reference frequency to all component streams is such that when zero count difference exists on the digital comparators, the total system flow rate will match the rate called for on the total-blend rate setter.

The system uses three "per cent component scalers" similar to the "ratio setters" except that they are calibrated in percentages.

These instruments modify the reference signal entering into each component control loop. Thus the component will be delivered to the percentage of the total that it is to represent.

It does what a packer is supposed to do...it packs off and stays packed off

an Important NEW Casing Pump Packer

For high volume high-cut pumping

For downright simplicity (and dependability) this new packer is in a class by itself • It's short—half the length of most casing pump packers • It's shorter because it's simpler. One reason is the simplicity of Baker's rocker-type slips, one of the great advances in slip design in recent years • Operation? That's simple, too, thanks to the J-Slot setting and release mechanism • It's short, so it's easier to ship, to warehouse, to handle. It's simple, so it's easier to run, to set, to unset, to retrieve • Moreover, it does what a packer is supposed to do—it packs off and stays packed off.

It's short and simple... a lean and potent design that makes the price lean and attractive

PRODUCT NO. 640

ITS STAMINA SURPRISED THIS OPERATOR

Operators like this robust new packer, and are a little amazed it takes such a beating. For instance, a Texas operator ran one into a well that was making a lot of water. Casing size was 5½", pump 3¾" with 1" rods, setting 2000 ft., fluid level 1200 ft. To test the packers, he pumped 1200 bbls a day with a 60" stroke, then upped it to 82" stroke and 19 strokes per minute. Result: 2000 bbls a day. The packer didn't creep or leak. That surprised the operator—he had doubted a packer could take that kind of beating. Now he's convinced.

PICTURES SHOW SIX IMPORTANT THINGS

Look at these two pictures. First note there's no tubing. You hang the packer on a large bore pump and run them both in on the rods. Second, it's all done in one trip. Third, you pump through the casing. Fourth, the packer's slips are the same rocker type made famous by Baker's high-performance squeeze tools. Fifth, you don't see a tail pipe. Thanks to the way the packing is designed (it seals by hydrostatic differential) you need neither tail pipe nor set-down weight to maintain pack-off. Sixth, that small hole above the packing is the unloading port that makes this packer so easy to run and retrieve.

WRITE FOR NEW ENGINEERING BULLETIN to Baker Oil Tools, Inc., Box 2274, Terminal Annex, Los Angeles 54, California.

FOR IMMEDIATE INFORMATION, see your local Baker man. This packer is also available through leading pump companies.

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AT THIS Kerr-McGee station in Oklahoma City, the motorist gets a choice . . . of nine gasoline blends.

Kerr-McGee Tries Out Custom Blending

KERR-McGEE Oil Industries, Inc., is offering nine custom blends of gasoline from multigrade pumps in one of its Oklahoma City retail outlets.

The experimental program is being carried out at a new Deep Rock super-service station at 36th St. and Santa Fe Avenue in the northeastern part of the city.

Unofficial reports are that gallonage has increased from about 20,000 to about 21,000 gallons per month, or about 5%, since the start of the program on January 9. About 40% of the motorists who stop for gasoline request one of the intermediate blends from the pump.

Kerr-McGee is providing a super-premium fuel of 101+ RON as the high-octane blending stock. This is about 2 octane numbers above the average for premium gasoline in the area. The low-octane blend is regular gasoline of about 91.5 octane, generally corresponding to the average for regular in the area.

Prices for the blends start at 30.9 cents per gallon, about normal for the area, and increase to 37.9 cents per gallon for the super premium. This is about 2 cents per gallon higher than the average for the area. Other prices:

Blend	Cents/ gallon
500	30.9
510	31.9
515	32.4
520	32.9
525	33.4
530	33.9
535	34.4
540	35.9
550	37.9

The station displays a list of recommended blends for a number of American standard and compact cars and for six imports. Six model years are covered, from 1956 through 1961.

Kerr-McGee recommends that the motorist start with the blend recommended for his car and work down, blend at a time, until he finds the lowest blend that gives "smooth, powerful performance."

How it works . . . The multigrade unit, a Wayne Pump Co. Blend-o-Matic, uses two separate fuel tanks, two fuel pumps, a blend-control valve, and a hose-within-a-hose. The two fuels are pumped and metered in careful proportion to the hose nozzle, where they are blended just as the gasoline goes into the tank. The blend-control

PROCESSING

A polybutenes plant has been brought on stream at Wood River, Ill. by Amoco Chemicals. The new unit increases Amoco's polybutene capacity 60%.

An oxo-alcohols plant will be built by Oxo Chemicals Co., at Haverhill, Ohio. The plant, scheduled for completion in early 1962, will produce several million pounds per year of isooctyl and decyl alcohols. Oxo is jointly owned by Pittsburgh Chemical and Amoco Chemicals.

A second polyolefin unit, costing approximately $6 million, will be built by Dow Chemical at Plaquemine, La. The plant, scheduled for completion in the second quarter of

valve adjusts the proportions of each base fuel, depending on the position of a blend selector on the pump.

Other programs . . . The Kerr-McGee experimental program is the latest of several.

Sun Oil Co., the original multigrade marketer, has been custom blending in about 9,000 service stations in the U. S. and Canada. Sun markets in six grades.

Signal Oil & Gas Co. is marketing seven grades at 95 stations in California and 61 in Texas, with more to come in the Miami area (OGJ, Dec. 12, 1960, p. 77).

A Signal official said recently that the company's venture into blended gasoline had raised sales significantly.

Lion Oil Co., which began marketing five grades in El Dorado, Ark., in the fall of 1959, has units in six stations there and now is seriously considering expanding multigrade operations into new marketing areas.

Anglo-American Exploration, Ltd., offers nine grades in Calgary, Alt. British Petroleum Co., Ltd., introduced multigrade marketing in Germany in 1959.

Sears, Roebuck & Co., Oklahoma City; A. H. Gandler, Omaha; and other private-brand dealers also market multigrade fuels.

Electronic Logic Beats Creators

• Computer programed with logic system devised by Shell engineers can outdo them in cutting plant costs.

A SYSTEM of logic worked out by a Shell Development Co. design group enables a computer to outdo the engineers who devised the system for chemical-plant design.

In matching wits with the design group, the computer came up with a scheme that cut $250,000 to $600,000 from the best the engineers had been able to do.

This amounted to a 5 to 6% savings in total construction costs. And the computer plan reduced production costs 5 to 10%.

The logic system was checked out on an ethylene-oxide plant.

Comparable savings were found when computer designs were run for polyisoprene and gasoline plants. Shell engineers and mathematicians are working on a similar program for oil refineries.

Called "Cheops" for Chemical Engineering Optimization System, the logic system requires mathematical models for each manufacturing unit. The links between units are equations governing the flow of all possible chemical streams in the plant complex.

The computer is fed three types of information:

. . . **The units needed** to produce the chemical and the stream routes between the units.

. . . **Information on the process,** with built-in rejections for impractical solutions.

. . . **The variables** which can be juggled—temperature, pressure, and other conditions — in seeking the most economic design.

First the computer comes out with a design and cost based on the original engineering information. Then Cheops goes to work quizzing the computer as to the effect of innumerable process manipulations. If a new design turns out to be an improvement, variables are changed.

This approach is repeated as the computer presses toward the optimum solution. When untried combinations appear promising, Cheops asks for more information.

With this fund of knowledge, Cheops is in a position to redesign a plant at the last minute to accommodate any sudden change in construction plans.

BRIEFS . . .

1962, will be capable of producing medium and high-density polyethylene, copolymers of ethylene, and polypropylene. Dow will also add polyolefin capacity at Saginaw, Mich., and bring on stream its polypropylene unit at Torrance, Calif., early this year.

Refinery shutdown at Sunburst, Mont., is scheduled by Texaco sometime this year. Operation of the 8,000-bbl. plant has been uneconomical for several years and the new Glacier Pipe Line now provides an alternate outlet for the crude.

A gas-processing plant, to be operated by Hunt Oil Co., will be built near McGregor, N. D. It will process oil-well gas from North Tioga and McGregor fields. The $2 million refrigerated-absorption-type plant will have capacity to handle 10,000 M.c.f. of gas daily and produce 15,000 gal. of propane, 10,000 gal. of butanes 7,000 gal. of natural gasoline, and 8 long tons of sulfur daily.

A linear polyethylene plant with capacity of 60 million pounds per year will be built by U. S. Industrial Chemicals Co., a division of National Distillers, adjacent to its conventional polyethylene facilities at Houston. Construction will begin sometime this spring and is scheduled for completion in the fourth quarter of 1962.

Acrylate esters expansion by Celanese Chemical Co. at the Pampa, Tex. plant has been completed, resulting in an over-all acrylate capacity of 30 million pounds per year. The newly completed facilities were designed to produce 14 million pounds of butyl, 2-ethylhexyl acrylate and glacial acrylic acid annually.

A carbon-black plant with a 64-million-pound-per-year capacity will be built 4 miles south of Mojave, Calif., by United Carbon Co. The Lummus Co. expects to complete construction within 10 months.

Ethylene capacity will be increased to 175 million pounds per year at Humble's Bayway, N. J., refinery. Humble's ethylene capacity will total 845 million pounds per year when this project is completed in the second quarter of 1962. Ethylene expansions are also planned at Humble's two Gulf Coast refineries.

Use of Plastic Pipe Widens

A NEW thermoplastic pipe is taking a good foothold in the industry.

Forty-five installations of the pipe have been made since its introduction last fall (OGJ, Oct. 17, p. 89).

About two-thirds of the lines have been oil-well flow lines. The others have been installed for salt-water disposal. Longest line is 8,600 ft.

The pipe, composed of a Delrin acetal resin made by the Du Pont Co., has been limited to 2-in. diameter. But larger—and smaller—sizes will be produced.

Pipe sections are joined in 25 seconds with the simple heat-fusion tool shown in the photo. The tool is connected to a portable generator or other source of current. Within 1 minute after the last joint is completed, the pipeline can be pressured up to the 200-psi. maximum operating level.

The installation shown is a new flow line from a producer in Kansas.

Next week the Journal will publish the first survey made of the use of plastic pipe in oil and gas fields.

Ohio to sell 20 million gallons of benzene to Dow Chemical yearly

THE ENTRANCE of Ohio Oil Co. as a supplier to the petrochemical industry has been made through an agreement to sell Dow Chemical Co. 20,000,000 gal. of benzene-toluene annually.

The mixture will be batched through Buckeye Pipe Line Co.'s 42-mile, 8-in. products line from Flint to Bay City, Mich., scheduled for construction this spring.

Shipments will be the first announced deliveries of this petrochemical in a refined-products pipeline.

Ohio will supply the petrochemical raw material from the Detroit refinery of Aurora Gasoline Co. its wholly owned subsidiary.

A multimillion-dollar expansion, primarily to produce benzene for Dow, will get under way late this year at the Aurora plant. The plant will use naphtha feed stock from Ohio's Robinson, Ill., refinery.

Dow will build a unit at its Bay City petrochemical plant to convert the benzene-toluene mixture to benzene for use at its Bay City and Midland plants.

Mecom Sets 9⅝-in. Casing at 15,644 ft.

TWO STRINGS of casing set by John W. Mecom in South Louisiana may have broken depth records for their diameters.

On a semi-wildcat in the Lake Washington field, a Mecom company, U. S. Oil of Louisiana, set 15,644 ft. of 9⅝-in. casing. The operation required 371 joints of pipe and 2,560 sacks of cement.

The other long string was 13,023 ft. of 10¾-in. casing, run in Mecom's ultradeep well which has been engineered to go 26,000 ft. if necessary (OGJ, Jan. 2, p. 47). The job required 10,000 cu. ft. of cement.

The job with the 9⅝-inch casing was carried out on the U. S. Oil of Louisiana No. 97 E. Cockrell, Jr., located 3,500 ft. northwest of the E. Cockrell Jr. No. 46, a gas well producing at 15,902 ft.

The No. 97 is downdip from the producing well on the northwest flank of the Lake Washington field and may require several thousand feet of additional drilling to reach pay sands. Operators were drilling below 15,653 last week.

The second job was on the John W. Mecom LL&E Unit S-1, located about 8 miles east and slightly south of the No. 97. The wells are in Plaquemines Parish between the Mississippi River and the Gulf of Mexico.

Mecom's operators report that both the casing job and drilling in general have proceeded without trouble. The 9⅝-in. hole is projected to some 22,000 ft. before an 8⅝-in. liner is set.

On the 10¾-in. casing, the operators used 313 joints of 55½-lb. N-80 pipe in a 15-in. hole. They waited 36 hours on a full return of the cement to the surface. The well has had no oil or gas shows yet.

The two strings of casing were set a day apart, on February 7 and 8. Operators didn't claim world records in the lengths of the strings, but said they knew of none that were longer.

Bethlehem Wire Rope On Its Third Well. This is Midland Exploration Company's Rig No. 14, drilling HDU9-4, a 12,000-ft well near Odessa, for Texas Gulf Production Co. At the time of the photograph, the well was at 9,520 ft. Though it was drilling its third well, the Bethlehem Wire Rope—1¼ in. 6 x 19 Form-Set, improved plow steel, right lay, with IWRC—showed no signs of tiring.

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BP Moves Fast in Canada

- **In 4 years the number of stations has jumped from 50 to over 800. And the company is "just beginning."**

FOR A COMPANY that entered Canada with an announced aim of "systematic and steady growth, specifically avoiding a crash program," British Petroleum has come a long way fast.

BP started with the purchase of some 50 retail outlets in February 1957. The number exceeded 100 at the end of that year, jumped beyond 350 at the end of 1958, approached 600 at the end of 1959, and now has passed 800—putting BP in a class with some of the established big names.

"And this is only a beginning," vows President A. F. Down of British Petroleum Co. of Canada, Ltd., parent company of BP Canada, Ltd., the marketing affiliate, and BP Refinery, Ltd., which operates a 25,000 - bbl. - daily refinery 12 miles east of Montreal.

The parent Canadian company is in turn wholly owned by British Petroleum Co., Ltd., London.

BP "statesmanship" . . . The worldwide experience of BP is evident in its manner of entering a new market.

BP is careful to respect Canadian national feeling on two sensitive points:

. . . Canadianization of local operations. Employes are 98% Canadian, and there is a promise of equity ownership by Canadians when the refining-marketing venture is firmly established.

. . . Products from imported crude run in its Montreal refinery are confined to the Ottawa Valley and Quebec. This is in accordance with the suggested lines drawn first by the Borden commission and more recently by Trade Minister George Hees in spelling out Canada's first official national oil policy.

Ontario requirements west of the Ottawa Valley are supplied by products refined from Canadian crude.

To minimize the market disturbance stemming from the entry of an aggressive new company, BP is moving at what it considers to be a reasonable expansion pace. At a 5% rate of annual growth, the company points out, the Ontario-Quebec market needs the equivalent of a new 25,000-bbl. refinery every year.

Marketing approach . . . BP set out to establish a chain of retail outlets largely by the purchase method.

Expansion today comes mostly from construction of new stations. However, the number of established outlets which BP took over still makes up the majority of the total.

Originally products were bought in the local market. Later storage tanks were constructed in order to receive products at the Montreal refinery site.

BP next began supplying outlets with products refined from its own Middle East crude under a processing arrangement with Texaco Canada, Ltd., at its Montreal East refinery. Last summer BP's own plant went on stream, supplying its Ottawa Valley and Quebec market.

Sales last year increased 67% above 1959.

What does this percentage gain mean in volume?

BP of Canada isn't divulging any operating data. To do so, President Down observes, "would spoil the fun of the competent statisticians whom our competitors employ for the very purpose of assessing such figures."

However, Down does report that the Montreal refinery started operating at over two-thirds of capacity, or around 17,000 bbl. daily.

Future expansion . . . BP has spent about $90 million to establish its refining and marketing operation in Ontario and Quebec, and has no idea of stopping there.

It plans to expand further in the eastern market, and to raise the BP flag also over the western landscape where the company has the beginnings of an exploration and producing program. The timetable has not been disclosed, but the intention is clear.

At the Montreal refinery dedication, Down said:

"One day we hope our operations will be as widespread right across Canada as today they are beginning to be in Quebec."

BP's competitors are wondering what share of the market will satisfy it. The feeling is that BP goals in Quebec are not limited to what can be supplied from the original refinery.

Alaskan Contract Okayed for Pure Oil

THE NINTH CONTRACT for oil and gas exploration and development in Alaska has been approved by Interior Secretary Stewart L. Udall. It requires Pure Oil Co. to drill at least three wells and spend at least $1,175,000 in the Nushagak Bay area.

The contract covers about 500,000 acres near the mouth of the Nushagak River, north of the Alaskan Peninsula and some 300 miles southwest of Anchorage.

Five million acres now are included in the nine contract areas in Alaska.

Udall said last week that since the first contract was approved in February 1953, 13 deep exploratory wells have been drilled.

These include three by Phillips Petroleum Co. in the Katalla-Yakataga area; four by Colorado Oil and Gas Corp. in the Icy Bay-Egegik area; one by Standard Oil Co. of California in the Kenai Peninsula Arm area; two by General Petroleum Corp. in the Becharof-Egegik area; two by Richfield Oil Co. in the Katalla-Yakataga No. 1 area; and one by Richfield Oil Co. in the Katalla-Yakataga No. 2 area.

The only producer of the 13 is the Kenai Peninsula well.

In addition, Pan American Petroleum Corp. has drilled two core holes in the Napatuk Creek area, and Union Oil Co. has completed two shallow wells in the Knik Arm area.

OPEC Lacks Magic Cure for Oil Ills

• Long-awaited report on Caracas meeting shows producing nations still haven't agreed on vital price and tax policies. Geneva will be headquarters for organization with Iran's Fuad Rouhani chief of staff.

ANYONE who might have expected the secrecy-shrouded Caracas meeting of the Organization of Petroleum Exporting Countries to solve producers' ills is going to be disappointed.

After a full 30-day delay, part of what took place in Venezuela's White Palace was revealed in six world capitals last week.

Perhaps the most significant revelation was that the six-nation combine of oil-producing countries has no magic formula for curing what they regard as major ills—low crude-oil prices and too little oil income.

In fact, after the heralded week-long meeting, the 27 representatives of middle eastern nations and Venezuela went home to formulate oil-pricing policies to mull over at the next OPEC meeting in Tehran some time around midyear.

Decisions revealed . . . On a more positive side, the Caracas meeting decided that:

. . . Geneva will be headquarters for the permanent OPEC organization.

This neutral European headquarters location has already come in for some implied criticism in the Arab world which supplies five of the countries in the six-member OPEC organization. Before last week's announcement, the Arabic press was reporting that the site would probably be Switzerland or Austria and telling its readers that there had been no explanation why the headquarters was to be located "outside the Arab world."

. . . A $420,000 budget for the initial organization was approved at Caracas.

. . . A six-man board of governors will direct OPEC activities, meeting at least four times a year. The agreement also calls for at least two annual conferences of the entire organization.

. . . Chairman of the board of governors will also serve as secretary general of OPEC. This would imply that Fuad Rouhani, a director of National Iranian Oil Co. who was named chairman of the board at Caracas, may have taken on a full-time job with OPEC.

. . . Permanent OPEC staff at Geneva will consist of a number of specialized departments including geology, marketing, production, finance, administration, public relations, and what OPEC called an "enforcement section."

Policies unsettled . . . It was obvious from the resolutions there has yet been no agreement on specific policies.

Specifics on prices and profits are being referred to special groups for study.

Initial announcements stressed that "most of the members" think oil company profits are "in excess of what may be regarded as fair" and promised recommendations for the Tehran meeting to act upon.

This profit reference was being widely interpreted last week to apply only to the Middle East producers. Venezuela, with increased income taxes on oil income, gets a bigger share of the profits on oil than goes to Middle East countries under the straight 50-50 profit split formula in effect there.

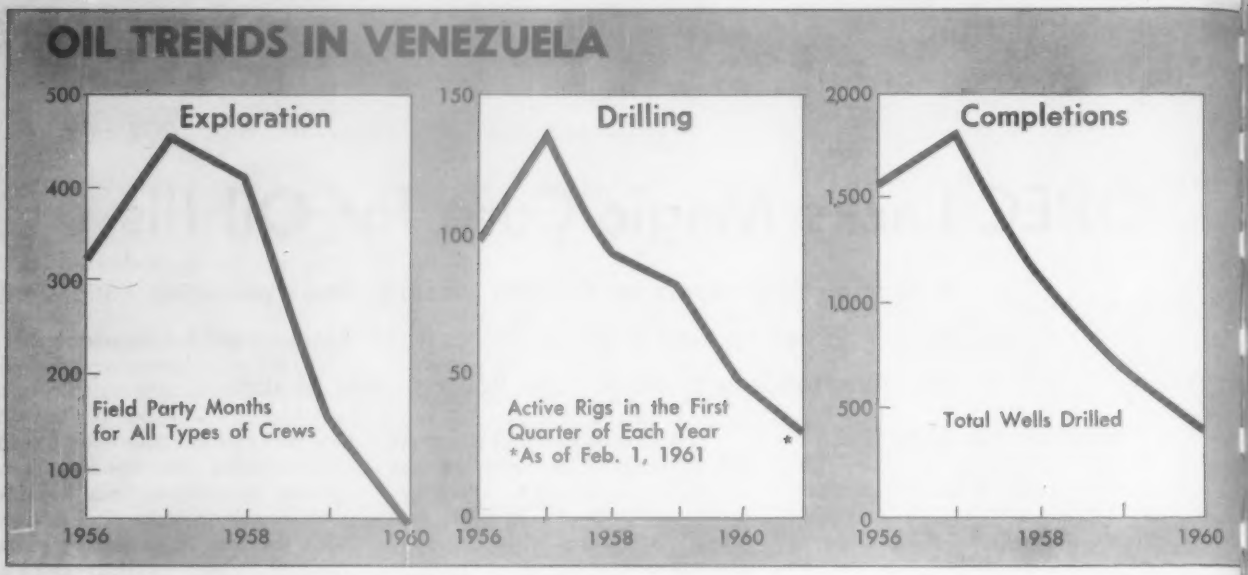
On the question of prices, OPEC spokesmen said each member nation has been asked to take a position on crude-oil prices for consideration at the next meeting. These various recommendations would then be submitted to legal advisers with the aim of "restoring prices to levels which members consider justified."

Here again the whole question applies to the Middle East rather than to Venezuela. Last August crude postings for Middle East oil were reduced from 4 cents to 14 cents a barrel, depending on the quality of the oil. The cuts were made by all companies which produce in the Middle East. The price drop has still not spread to Venezuela, largely because Dr. Juan Pablo Perez Alfonzo, Venezuelan oil minister, has threatened to shut down the operations of any company which shaves oil prices.

New approach . . . The whole approach of asking for individual country positions on prices and then asking legal advice on what to do represents a much more moderate stand than voiced by many OPEC members before the secret sessions at Caracas.

Shaikh Abdullah Tariki of Saudi Arabia has said that his country's 1960 taxes would be computed on the basis of prices before the cut. Mohammed Salman of Iraq said flatly that all the Middle East countries had informed companies they would not "accept" the price cut.

One of the strangest resolutions revealed last week pointed out that OPEC's attention had been called to the "curtailment of activities in the development of the Venezuelan petroleum industry." (See page 100.) The resolution said OPEC intended to examine the Venezuelan situation and propose remedies.



Uncertain Future Faces Already Dormant

Paul Swain
International editor

VENEZUELA is turning its back on a private oil industry that has made the country the economic leader of Latin America for the past 40 years.

The visionary administration of President Romulo Betancourt has slowly, but firmly, put its foot on the neck of a once-thriving industry.

The oil policy of the Betancourt regime has robbed the country's oil industry of the two things that are essential to any growing industry—its incentive and vigor.

By every yardstick available, Venezuela's oil industry is on the decline. Unless the government revises its oil policy, and this is unlikely, it will continue to go downhill.

In only one respect is Venezuela's oil industry holding its own. That's in daily production, and here the country is reaching a plateau that it is able to maintain only because of a productive capacity that has been built up in past years.

Last year Venezuelan oil production was only 2.7% higher than in 1959. The average increase over the past decade was about 8% per year. It is a real question whether Venezuela can long expect even such slight growth as was experienced in 1960 unless there is corresponding expansion in capital investment, exploration, and drilling.

President Betancourt is serenely happy with this situation. The oil industry is not. But it may take years to prove which is right in basic philosophy. If, as the industry believes, Betancourt is proved wrong, it will be too late to do anything about it. By then Venezuela will be eclipsed as an oil power.

"I would rather have my hand cut off than to deviate a single millimeter from the government's policy on oil concessions," Betancourt recently told a meeting of his own political party, Accion Democratica, in Caracas.

"There will be no more oil concessions," he repeated. "All unassigned oil reserves will be transferred to the Venezuelan Petroleum Corporation."

In other words, the president of Venezuela has turned his back on an industry that has more than $6 billion in capital invested in his country and that poured $5 billion into the national treasury in just the last 5 years.

He is placing the fiscal future of Venezuela in the hands of a national "paper" company with few assets, no experience, and few persons qualified as oil men.

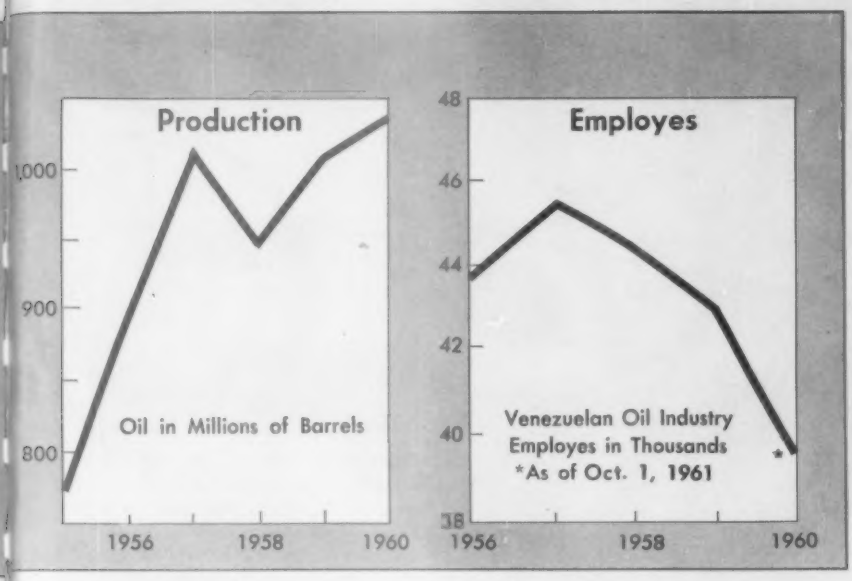
The concession question . . . The present Venezuelan Government, now 2 years old, and the country's 40-year-old oil industry have never seen eye-to-eye on the question of a concession policy, but the cleavage has never been quite so definite as it is now.

Betancourt was elected president of Venezuela after a dictator was overthrown. One of his campaign promises was that there would be no more concessions granted to private oil companies. He was quick to point out then, and his administration has repeated many times since, that the companies do not need new areas because more than 90% of the acreage they hold has not been explored.

This is hotly disputed by the companies. The industry says that of the 12.6 million acres now held under concession by private companies in Venezuela only about 6% has not been explored by geological or geophysical work.

Of this total acreage, 9.5% is regarded as proved by the companies; 14.7% is definitely non-commercial; 32.2% has been completely explored but is commercially unproductive at present, and the remainder has been gone over geologically and by geophysical work, but has not been tested by drilling.

Far more indicative of what the



Venezuelan Oil Industry

industry thinks of the exploratory acreage it now holds is the fact that preliminary exploration work has come to a grinding halt. The last geophysical crew finished its last job in Venezuela in July. Today there are only two geological field parties at work in the entire country.

This is in sharp contrast to the 460 party months of field exploration of all kinds that took place in the peak year of 1957. Last year this dropped to 45 party months.

The new national company . . . The government oil company which Betancourt promised Venezuela has finally been formed and has a board of directors (OGJ, Jan. 9, page 64).

Even Betancourt concedes that it is starting out small, but he says it will soon become a multimillion dollar company. The private oil companies which invested a gross $317 million in Venezuela last year are just a bit skeptical when they look at the authorized $2.3 million capital which the new company has to spend.

The newly formed company is now advertising in Caracas newspapers for bids on a Lake Maracaibo platform from which a contractor will drill its first well. The location has not been disclosed, but it is almost certain to be in an "L-shaped" 330,000-acre tract in central Maracaibo offsetting proved production by two private oil companies.

The government company estimates the first well will cost $712,000. The estimate is broken down as follows: $130,000 for the platform; $140,000 for the drilling contractor; $145,000 for tubular goods: $110,000 for transportation and miscellaneous costs: $40,000 for drilling mud; $83,000 for technical services; and $64,000 for contingencies.

If the national company establishes production with this kind of a drilling operation, it undoubtedly will try to make a deal with one of the private companies to market the crude. Dr. Juan Pablo Perez Alfonzo, minister of mines, is talking in terms of production of 10,000 bbl. daily before the end of this year.

Dr. Perez Alfonzo also talks confidently of the new national company's adding to Venezuela's reserves because, as he says, that is one of the purposes of forming the company.

The private oil industry in Venezuela is tightening its belt in an atmosphere that offers little hope for an expanded future.

In the meantime, Venezuela expects its national company to provide all the expansion it feels necessary for the future.

Only time will tell.

FOREIGN BRIEFS . . .

Bids for developing two 12-square-mile producing areas in Argentina's Santa Cruz Province will be opened April 27. YPF is limiting bids to local companies at first. If these are unaccepetable, foreign companies will be invited to bid.

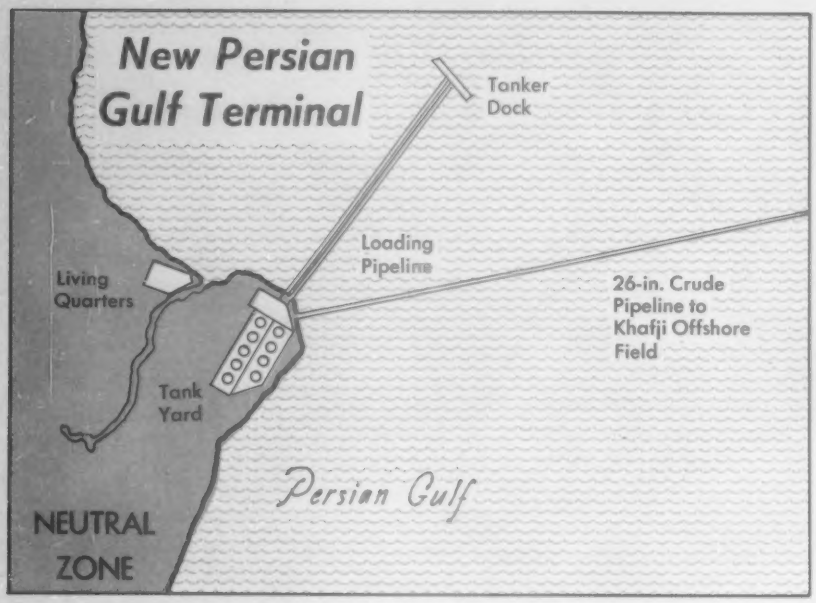
A big Soviet discovery is reported near the town of Tsiteli-Tskaro in Georgia. The well, near the Azerbaijan border, is said to be flowing several times the total of 200 small existing producers in the republic. Pay is at 3,480 ft.

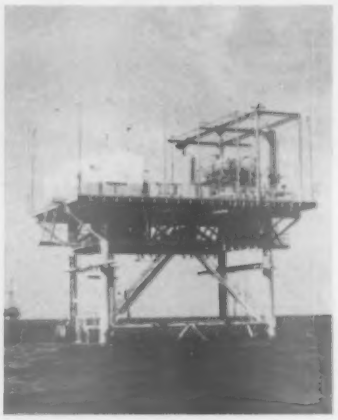
A new topping unit will be constructed at Mobil Oil Ltd.'s refinery in Coryton, England. Site clearance has started for the unit that will increase capacity to 46,000 bbl. daily. The new installation will improve the quality of heavy fuel oil by reducing sulfur content.

A Burmese exploration contract covering 10,000 miles in The Irawaddy basin has been awarded to General Exploration Co. of California. This is Burma's first grant to a foreign firm other than Burma Oil Co., which is owned 51% by the Burmese Government.

Interest in an offshore license off southern Australia has been obtained by Burmah Oil Co. The rights, held by Australian Pacific Co., extend from the coast south of Adelaide to the Victoria border, and include Kangaroo Island.

YPF exports of 4.3 million barrels of crude to Uruguay's state oil agency, ANCAP, are planned over a 3-year period. Price of the crude, from Tierra del Fuego and Canadon Seco fields, has not been negotiated.





FOUR flow stations like the one above will be part of the facilities now being constructed to move oil from Khafji field in the Persian Gulf. One flow station will be used for every eight or nine wells in the new Japanese field.

First Khafji Crude Will Start Moving Soon

- Limited production scheduled in new Japanese field off Neutral Zone when temporary loading facilities are completed. Tankers will begin runs from Persian Gulf to Japan in March. Target is movement of 200,000 bbl. daily.

THE FIRST flow station is being completed in a program to build facilities to move 200,000 bbl. daily from the new Japanese oil field in the Persian Gulf.

Tokyo-based Arabian Oil Co. expects to start limited production from the first nine wells in Khafji field off the Neutral Zone as soon as temporary loading facilities are finished.

Permanent facilities to move 200,000 bbl. daily will be in operation in 2 years. They will include four flow stations, or one for every eight or nine wells, and a big gathering station. A 26-in. submarine crude line will run to an onshore terminal at Khafji.

Land-side facilities will include a gas-oil separator, nine crude tanks of 220,000 bbl. capacity each, a pump station, power-generating plant, remote-control equipment, and living quarters. Incoming tankers will berth at a loading dock 2.8 miles offshore.

Temporary facilities . . . Bad weather in the Persian Gulf has put construction of temporary loading facilities slightly behind schedule. The original plan to move 2.5 million barrels of Khafji crude to Japan during the first quarter of 1961 is being revised.

The first cargo of crude is now expected to arrive in Japan around the end of March. It will be carried by a Daikyo Oil tanker, the 21,000-ton Jingu-maru. Daikyo Oil is a Japanese independent that handles 4 to 5% of the country's refining and marketing.

The company will make a trial run of the 26°-gravity crude at its 55,000-bbl. Yokkaichi refinery. The chief cut will be fuel oil for use in an electric-utility plant operated by Chubu Denryoku.

The Jingu-maru will be loaded from a sea berth at the field. This will be supplied by 12¾-in. loading lines from five tankers being used for temporary storage.

Each storage tanker has a capacity of slightly more than 100,000 bbl. These will be supplied by 12¾-in. loading lines from the flow station. Individual wells are connected to the flow station by 6⅝ to 8⅝-in. feeder lines.

McDermott International is building the temporary facilities.

Ten out of ten wells have been completed as producers by Arabian Oil. The No. 10 is rated at 6,300 bbl. daily, the same class well as the first nine tests. The producing horizon lies at 5,500 ft.

Drilling time has averaged 40 days per well.

Looking for market . . . Negotiations are in progress between Arabian Oil, the Japanese Government, and representatives of the major companies in Japan, Shell, Caltex, and Stanvac.

No long-term formula for distributing the crude among Japanese refiners has been agreed upon. But outlets have been found for first-quarter shipments.

The crude is expected to have an advantage in Japanese markets because it can be partially paid for in yen.

Arabian Oil will pay up to 56% of the net profits on Saudi Arabia's undivided half interest in the concession. It will pay Kuwait up to 57% on the other half interest. The share of the cost earmarked for royalties must be paid in dollars, but the rest will be payable in yen.

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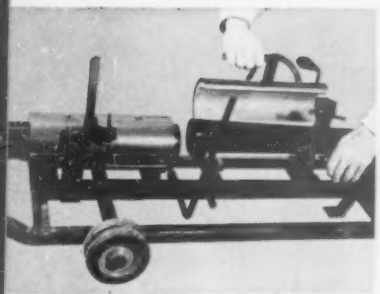
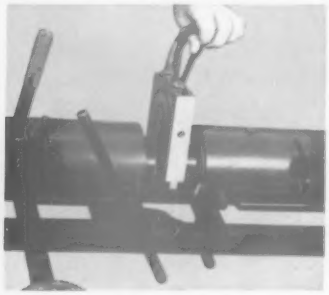
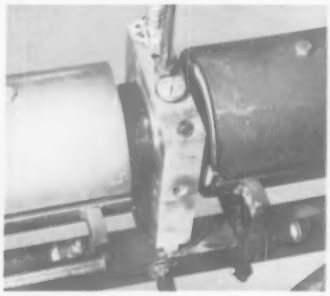


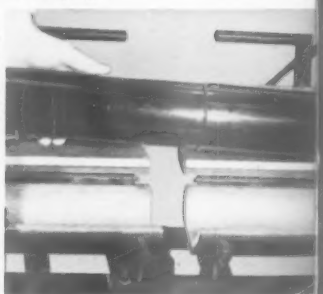
Pipe or conduit is clamped in portable fusion rig.



Thermostatically controlled heating plate is inserted.



Ends to be joined are heated in a matter of seconds.



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JOURNAL SURVEY ON how refiners are combating AIR POLLUTION

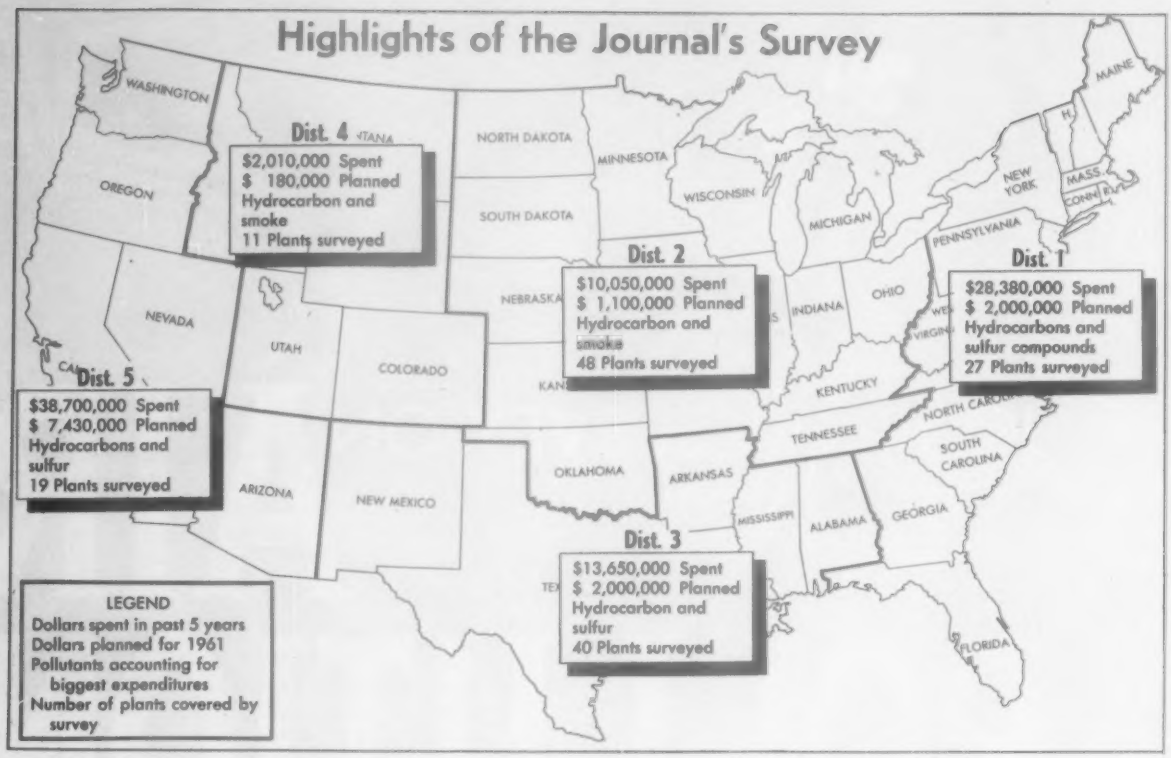
REFINERS ARE CONTINUING their efforts to control aerial wastes from their plants, the Journal's second survey finds. Based on replies from refiners accounting for 83% of the U. S. plant capacity, the survey shows:

. . . This year about $12.7 million will be spent for APC measures, compared with $14.6 million in 1960, $15.7 million in 1959, $17.4 million in 1958, $22.5 million in 1957, and $22.5 million in 1956.

. . . The declining trend is an indication refiners are getting their houses in order, particularly so in view of the smaller additions made to capacity and the better controls provided in new units.

. . . Biggest expenditures are for controlling hydrocarbons, most of which are saturated compounds whose role as a pollutant is still questionable.

. . . Research in the APC field will total more than $1 million. Of this, half will be for intercompany-sponsored research. The other half will be spent by oil companies in conducting their own research.



JOURNAL SURVEY SHOWS

Refiners continue attack

The running battle refiners are waging with air pollution is a long way from being settled if current expenditures for control measures are sole gage.

This year about $12,700,000 will be spent to control emissions from plants throughout the U. S. This would bring the refiners' 6-year investment in air pollution control measures up to a total of more than $105,000,000.

Most of this year's expenditures will be to curb hydrocarbons, either through combustion or by installing equipment for their recovery or control. Major portion of the hydrocarbons controlled will be saturated compounds whose role as a pollutant is still highly questionable. Relatively little will be for smoke and particulate-matter control.

Some of the measures will have a payout of some sort or other. But a sizable portion will have to be charged off as a good-will gesture to the public—a public which is increasingly vocal in demanding that industry stop polluting the atmosphere of our urban areas.

This year's outlay will be below the level of the past 3 years. It is not an indication that refiners are easing off, however, or that the need is lessening. In fact, such a decrease should be expected.

The reason is that more and more controls are being designed into new units before they are built. Thus there is less need for corrective action later on, which is the case with a sizable portion of the control measures undertaken in the past.

In addition to these equipment

Amounts Spent

Pollutant Controlled	District 1		
	1956-1957	1958-1960	1961
Recovery and control of hydrocarbons	$4,759	$5,417	$908
Combustion of hydrocarbons	3,058	331	332
Sulfur Compounds	5,787	2,544	16
Smoke and Particulate Matter	1,350	1,266	115
Odors and Fumes	910	375	434

expenditures, over $500,000 is being spent annually in company research. About the same amount is being contributed to air-pollution research groups.

We made a survey. Because of the growing interest in air pollution, 3 years ago the Journal surveyed the nation's large refiners to find out the extent to which they were controlling aerial emissions, and how much they were spending (OGJ, Feb. 17, 1958, p. 88).

The first such national survey made in the petroleum industry, it revealed that 35 companies had spent almost $20,000,000 annually in 1956 and 1957, and that they expected to spend more than $17,000,000 in 1958.

These companies accounted for 77% of the total U. S. refining capacity. So the data were projected to annual expenditures of $23,000,000 in '56 and '57, and to an estimated $20,500,000 for 1958.

To see what the current situation is, a second survey was made at the close of 1960. More extensive than

on air pollution

BY D. H. STORMONT, REFINING EDITOR

t by 56 Companies in Controlling Various Pollutants

(In thousands of dollars)

District 2			District 3			District 4			District 5			Total		
1956-1957	1958-1960	1961	1956-1957	1958-1960	1961	1956-1957	1958-1960	1961	1956-1957	1958-1960	1961	1956-1957	1958-1960	1961
$ 392	$3,139	$ 66	$1,055	$2,294	$691	...	$433	$30	$4,443	$10,021	$1,070	$10,649	$21,304	$2,765
601	186	90	630	769	33	1,118	20	50	4,547	6,628	4,785	9,954	7,934	5,290
373	560	191	2,400	1,575	895	...	24	60	3,748	4,210	1,031	12,308	8,913	2,193
1,086	615	380	1,415	394	38	100	...	15	350	1,771	78	4,301	4,046	626
516	379	87	463	361	83	..	185	10	453	437	224	2,342	1,737	838

the first, all refiners with plants above 20,000-bbl.-daily crude capacity were queried. Data supplied by these companies on their smaller plants, plus a sampling from other small refiners throughout the nation, extend the survey down to plants in the less-than-5,000-bbl. class.

Of the 75 companies queried, replies were received from 56 (only one major refiner did not supply data). The 145 plants covered account for 8,472,000 bbl. or 83% of the U. S. refining capacity.

Of those replying, 21 reported no capital expenditure for control measures during 1958-60 and planned none for 1961. Bulk of these were in Middle West and Southwest communities where air pollution generally is a less pressing problem.

Reflecting the trend of the times, 12 refiners who did not find it necessary to install control measures before 1958 did so during the past 3 years.

Before going further, a word about the values of using dollars as a measure in the progress of air pollution control. Capital expenditures should be taken only as a guide, not as a gage of accomplishment.

"Before going further, a word about the value of using dollars as a measure in the progress of air pollution control. Capital expenditures should be taken only as a guide, not as a gage of accomplishment."

Some large expenditures required by local ordinances may contribute

Case history: The 4-year cost of APC at one California refinery

Because refineries vary in both the need for control and as a source of air pollution, average figures are more or less meaningless. But there is little question that control measures can be expensive, particularly if the plant is located where air pollution is a problem.

Following are the detailed cost figures reported for one of the larger West Coast plants. It should be noted that some of the costs represent only the incremental portion chargeable to air-pollution control, not the total cost of the measure. Also worthy of note are the many projects with poor or no payout.

Projects completed during 1958-60:

	Cost, in $1,000	Planned payout: Good	Fair	Poor or none
1. To reduce particulates				
Electrostatic precipitator for cat cracker	1,100			✓
Wet scrubber for cat cracker	85			✓
Clay unloading alterations	12	✓		
Cyclone for cat cracker kiln	3.5			✓
Stratco drier	25*			✓
Shot-blasting dust control	4			✓
Fume scrubber	27.6			✓
Plume-removal facilities at cat crackers	18			✓
Eliminating steam plume	31			✓
Other controls	7.3			✓
Total	1,313.4			
2. To reduce smoke				
Flare tips, etc. for cat cracker flare	60			✓
Crude-unit smokeless flare	56			✓
Dry firing scrubber for lube plant	10			✓
Smokeless flare for cat cracker	50			✓
Smoke indicators	3			✓
Other controls	2.7	✓		
Total	181.7			
3. To reduce odors				
Tank floating roof	2.5			✓
Reflux pump for acid plant	5			✓
Mercaptan car-loading facilities	1.5			✓
Fume incinerator at sulfide oxidizer	25			✓
Fume incinerator petrochem plant	110			✓
Fume scrubber	2.5			✓
Other controls	2			✓
Total	148.5			
4. To reduce sulfur oxides				
Hydrogen sulfide plant	1,500			†
SO_2 monitoring station	14.5			✓
Hydrogen sulfide scrubber	75			✓
Total	1589.5			
5. To reduce hydrocarbons				
Mechanical seals on pumps	†17.5			✓
Carbon monoxide boiler	800†			✓
Floating roofs on new tanks	195†			✓
Blowdown modernization at lube plant	325			✓
Replacing cone roofs with floating roofs on five tanks (1958)	94‡			✓
Replacing cone roofs with floating roofs on five tanks (1960)	212.5‡			✓
Spent caustic degassing facilities	13.5			✓
Other controls	1.6			✓
Total	1659.1			

Projects planned for 1961:

	Cost, in $1,000	Planned payout: Good	Fair	Poor or none
1. To reduce particulates				
Eliminate vents on cat cracker fines hopper	25			✓
Vent system	20			✓
Reduce paint spray vapors	28			✓
Heat exchanger cutoff saw	5	✓		
Total	78			
2. To reduce odors				
Reduce odors at acid and lube-treating plants	30			✓
Fume disposal, tank-car loading rack	25			✓
Total	55			
3. To reduce hydrocarbons				
Replace cone roofs with floating roofs at four tanks	123‡			✓
Flue-gas recovery at lube-dewaxing plant	35	✓		
Total	158			
4. Steam plume elimination				
Reduce exhaust steam discharge to atmos.	50			✓
Total of planned projects	311			

*Air-pollution-control portion only. †Payout has not been evaluated. ‡Incremental cost of (1) mechanical seals over packing, (2) CO boiler over conventional, (3) floating roof over cone roof.

PIPE ALLEYS in the condition such as this one are not only an eyesore, but also contribute to both air and water pollution.

POLLUTION IS NO PROBLEM, and maintenance is much easier, in this well-designed pipe alley.

relatively little toward solving the community's air-pollution problem. Likewise some large outlays are economically justified. On the other hand, a lot of benefit—particularly in odor control—can be realized from very little capital expenditure.

Cost of controls. The 35 companies reporting expenditures spent $16,000,000 for control measures in 1958, $14,500,000 in 1959, and $13,500,000 in 1960. This year they plan to spend $11,700,000. Since there has been little expansion in capacity during these years, the declining expenditures indicate refiners are getting their houses in order.

Based on expenditures of these companies, the total costs shown in accompanying tables were arrived at by projection. Since most of the plants not covered in the survey are in the small-to-medium class, and are located principally in cities and towns where air pollution is a minor problem, a 50% discount factor was applied in estimating their expenditures.

... **West Coast refiners** account for about three-fifths of the total expenditures. Also, as the table on the next page shows, there is little tapering off in their annual expenditures.

This year they will spend about $7,400,000, as compared with an average of $7,500,000 during 1956-57 and $7,900,000 in the 1958-1960 period.

As would be expected from the rigid control measures in force there, Los Angeles refiners lead all other areas in expenditures. Eight companies with plants in the Los Angeles Basin reported planned projects for this year costing $5,581,000. Their outlay during the past 3 years totaled $15,417,000.

At the first of 1958, they had spent approximately $33,000,000 in curbing hydrocarbons and other pollutants from their plants and bulk loading terminals. By the end of this year, their air-pollution control (APC) investment thus will be about $54,000,000.

San Francisco refiners also are extending their control measures. The four refiners with plants in the bay area reported they had spent $6,080,000 in the past 3 years. During 1961, they plan spending an additional $1,116,000. Most of the expenditures are to meet new ordinances passed last spring and which become effective the first of next year.

... **East Coast refiners** will spend about $2,000,000 this year, of which almost half will be for hydrocarbon control and recovery. This year's outlay is down slightly from the 1958-60 average. A large percentage of the corrective measures are being undertaken in plants in the New York-Philadelphia area.

... **On the Gulf Coast,** measures which will reduce sulfur compounds are accounting for about one-half of the $2,000,000 to be spent there this year.

... **Middle West refiners** and those in the Rocky Mountain area, where air pollution is not the problem it is on the East and West Coasts, will spend about $1,300,000 this year. Hydrocarbon recovery and control of smoke and particulate matter account for much of the work there.

Type of contaminants controlled. As was the case in the survey 3 years ago, expenditures for hydrocarbon control and combustion account for more than half of the total. Control of sulfur compounds require the second largest outlay, with smoke and particulate matter, and odor and fumes trailing in that order. (Table, pp. 106-107.)

The type of control measures applied in the various districts (old Bureau of Mines designation) reflect the needs of the area and the severity of control laws.

In California, where hydrocarbon vapors have been the primary target of laws and ordinances, their control is the principal aim. Elsewhere, control of sulfur and smoke are of equal or greater importance. But there too, hydrocarbon recovery and combustion are accounting for increasingly large expenditures.

... **Hydrocarbon recovery** measure accounting for the largest expenditure is the installation of floating roof tankage, or vapor-recovery

systems tied to storage tanks. Where floating roofs were installed on new tankage, or to replace a cone roof on old tankage, only the incremental higher cost of the floating roof was used in this survey. On a 120-ft.-diameter tank, the incremental cost on a new tank is about $30,000; as a replacement, some $70,000.

A high-cost control item included in this category is the use of light hydrogenation units to reduce the olefin content of motor fuel. Three Los Angeles refiners last year found it necessary to install such units in order to comply with the Air Pollution Control District's (APCD) new regulation (Rule 63) limiting olefins in gasoline.

Another hydrocarbon-vapor control accounting for large outlays is in cleaning up refinery waste waters. At many plants throughout the U. S., open systems are being replaced by fully or partially enclosed skimming sections.

Refiners also are reducing hydrocarbon flaring. In some instances the flare system is being tied into the vapor-recovery system. One refiner will install a gas holder to further reduce vapors flared during upsets and turnarounds.

. . . Hydrocarbon combustion expenditures this year for the first time will exceed those for recovery and control. This is due principally to the construction of two large waste-heat or carbon monoxide boilers at two Los Angeles refineries, each costing about $2,300,000. As they are being installed in connection with existing cat cracking units, both companies reported a poor payout is expected.

Other expenditures in this category center largely around steps to burn off-gases, as well as those stripped from spent-acid and doctor-treating solutions.

. . . Controlling sulfur compounds this year will account for only one-third of the total. Almost all of the cost is in connection with H_2S-recovery plants, with about half of the $2,200,000 total being spent at California plants. Gulf Coast refiners will spend about $900,000, more than one-half of their total APC expenditure.

After spending about $10,000,000, Los Angeles refiners are recovering almost 400 tons of sulfur daily. According to data compiled by the APCD, in 1948 only 70 tons daily were being recovered from refinery gas streams. By 1956 this had been increased to 300 tons and in 1959 it had been stepped up to 350 tons daily. Most of this sulfur is converted to sulfuric acid.

Earlier plants, built either by the refiner or an adjacent chemical company, were reported to have some economic value even though the payout was slow. Because of the small volumes now being dealt with, almost all of the Los Angeles projects will operate at a loss.

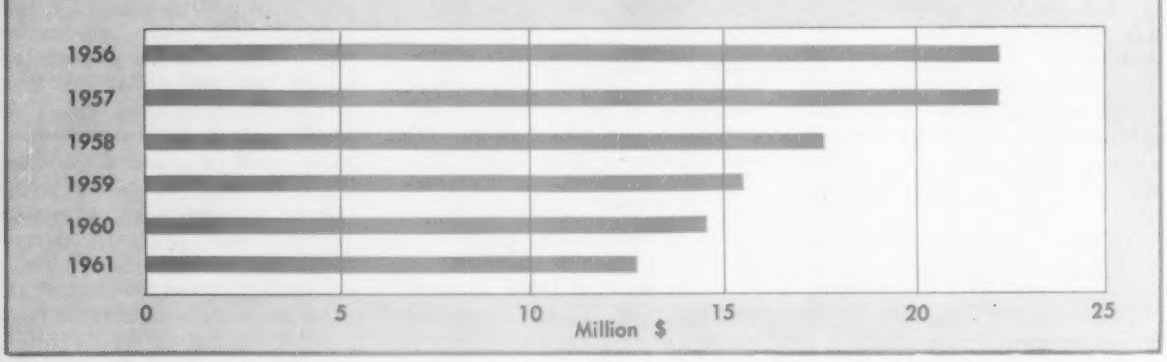
While the amount of sulfur being recovered is substantial, it represents only about 1% of the total sulfur (as SO_2) being released to the Los Angeles atmosphere. Originally it was believed that sulfur oxides played no role in the area's smog problem. More recent work indicates they do form aerosols and thereby affect visibility. Very small traces of sulfur dioxide promote smog formation, it has been found, but increasing the amount of sulfur dioxide has no additional effect. Thus the over-all effort to control these emissions probably has had little effect on that area's smog problem.

Adoption of rules limiting the amount of sulfur compounds contained in stack gases caused San

What Air Pollution Control Costs at U. S. Refineries

District (B of M)	Refining capacity, 1,000 B/D	Capacity covered in survey, %	Number of plants covered	Estimated total for all refineries (in $1,000)					Planned for 1961	Total
				1956*	1957*	1958	1959	1960		
1	1,734	83	27	$ 8,690	$ 8,690	$ 6,200	$ 2,100	$ 2,700	$ 2,000	$ 30,380
2	2,915	73	48	2,100	2,100	2,400	2,450	1,000	1,100	11,150
3	3,680	88	40	3,600	3,600	2,750	1,400	2,300	2,000	15,650
4	328	93	11	640	640	170	30	530	180	2,190
5	1,580	89	19	7,500	7,500	5,900	9,700	8,100	7,430	46,130
Total	10,267	83	145	$22,530	$22,530	$17,420	$15,680	$14,630	$12,710	$105,500

*Average during 2-year period.



CAREFUL ATTENTION to sources of pollution by refinery operators can do much to cut down on the problem.

Francisco refiners to undertake more H_2S-recovery projects. Facilities already installed are extracting 140 tons of sulfur daily. This is about 70% of the amount which would be emitted without controls. Work planned for this year will further increase this amount.

... **Smoke and particulate**-matter control measures account for the smallest portion of this year's expenditures. That they are materially below the past 5-year average indicates smoking stacks, cat cracker plumes, and flares systems are well under control.

Smoking stacks are being controlled in numerous ways. Some refiners reported installing extra-tall stacks, to obtain better dissipation. Likewise a few afterburners or "sky-heaters," were reported. Mostly, however, the steps taken centered around better control of combustion in furnaces.

They involve installation of instruments which measure and record the concentration of carbon dioxide, carbon monoxide, and oxygen in stack gases. These generally are tied into alarm systems which call attention to a smoky stack.

Other devices automatically control fuel supply in proportion to the heat requirement, maintaining proper air-fuel ratios and proper atomization of the fuel. All is done in such a manner as to prevent smoking.

Originally installed as a safety device, refinery flare systems have been made a useful APC tool through the development of smokeless flares. Most use steam jets to obtain a thorough air-gas mix. Smokeless burning is attained during upsets by means of automatic controls which regulate the steam flow to the volume of gases to be burned. Ranging in cost from about $10,000 to $70,000, these flares yield no return.

Reductions in particulate matter center around catalytic cracking units and are effected principally through use of cyclones and electrical precipitators. Cyclones are economically justified but such is seldom now the case for electrical precipitators. Improved catalysts and process refinements have reduced catalyst losses to such an extent that at most fluid units the precipitator is solely an air-pollution-control measure.

... **Odor and fume control** is somewhat of a catch-all classification since most control measures result in odor abatement. It largely applies to measures where odor control is the goal. It follows that no payout results.

Included are such projects as: (1) use of masking agents to cover up bad odors, (2) elimination of oil-soaked open pits and basins, (3) better methods of dealing with spent-caustic solutions, (4) incineration of air used in blowing operations, and (5) separation and incineration of mercaptans and H_2S from refinery wastes. Steam plume elimination also is included, even though no odor control is involved.

Economic value. As in the previous survey, refiners were asked to give an indication of the project's payout by rating it "good," "fair," or "poor or none." This was not done in all cases. However, the accompanying chart (p. 112) shows the rating of about $48,000,000 worth of equipment installed in the past 3 years and planned for 1961.

For the U. S., 19% of the total expenditure was expected to yield a good payout, 21% a fair return, and 60% would have a poor payout or none at all. This picture, however, is greatly affected by the large expenditures on the West Coast.

There, 86% of the projects fall in the "poor" category. Only 7% of the control measures have a good payout. This compares with 53% on the Gulf Coast, 39% in the Rocky Mountains, 28% on the East Coast, and 18% in the Middle West. This reflects the high degree to which California refiners have eliminated air pollution in their plants.

Payouts of the various classes of control measures have been highlighted in the foregoing discussion. As a general rule, however, those measures associated with hydrocarbon recovery show the highest percentage of "good" payouts.

Other benefits. Most of the discussion so far has been concerned with the "cost" of air-pollution control. There is no question that an over-all net loss results, but there are some benefits too—both tangible and intangible.

Questioned in the survey, "If you have found that your over-all refinery efficiency increased as a result

Relative payout of APC equipment

. . . installed and planned by 56 companies—1958-1961

District:	Expenditures (in $1,000) which were:			Percentage of expenditures which were:		
	Good	Fair	Poor or none	Good	Fair	Poor or none
1	$2,933	$4,217	$3,170	28	41	31
2	952	2,085	2,292	18	39	43
3	3,120	1,668	1,118	53	28	19
4	300	300	166	39	39	22
5	1,906	1,908	22,196	7	7	86
Total U. S.	$9,211	$10,178	$28,942	19	21	60

of your efforts to curb air pollution, list some of the benefits noted," here are some of the replies received:

. . . **"Improved fuel-burner efficiency,"** and similar comments on better combustion were reported by numerous refiners. One said, "Boiler efficiency was improved by 3-5%."

. . . **"The only efficiency increase** is the result of mechanical seals on light-oil pumps, and the industry should install them regardless of the fact that APCD rules require them," was the comment of a Los Angeles refiner.

. . . **Reduced flaring** was a frequently mentioned benefit, as was reduced oil losses resulting from installation of floating roofs.

. . . **"Reduced corrosion** on boiler air preheater" and "increased oil recovery from asphalt-blowing fumes," were two other benefits reported. "Decreased loss of fluid cracking catalyst" was mentioned by a Texas refiner.

"Over-all refinery efficiency has increased. However, as we have only recently adopted a program to work toward, we are unable to be specific," an Oklahoma refiner noted.

Another tangible benefit reported was, "The over-all pollution-control effort has resulted in a very active stock-loss-control program."

. . . **Intangible - benefit** comments were varied and as numerous as those dealing with economics.

Reductions in SO_2 emissions by removal of H_2S prior to use of process gas as fuel, and general reduction in other odor emissions, have noticeably improved working conditions," a California refiner noted.

"A continuing program to prevent air (and water) contamination keeps employes aware of the problems and fosters better work habits and good housekeeping," was the statement of a Texas refiner.

One refiner said a benefit was "Improved working conditions through abatement of dusts and odors." Several mentioned the improved housekeeping benefits, likewise the improved alertness and awareness of operating variables by plant personnel.

. . . **Better public relations,** and improved community relations, were frequently touched upon.

In regard to community relations, it would appear that the residents around the average refinery are becoming more vocal. Or it may be that better records are being kept of complaints. Whatever the reason, the survey showed only a slight decrease in complaints despite the large sums being spent to curb pollution.

To gain some insight on the number of complaints, the refiners surveyed were asked how many they had received annually for the past 5 years. In most cases the answer was that they were not recorded, or that no complaints had been received. The replies received from 37 plants are compiled by districts in accompanying table, the table at the bottom of this page.

These are the number of complaints received. They do not indicate that the refinery was the source of the complaint. But it could be concluded that the public is more air-pollution conscious.

That this is the case is indicated by the record of one Los Angeles refinery which listed the following complaints: 3 in 1956, 11 in 1957, 10 in 1958, 21 in 1959, and 24 during the first 10 months of 1960. Though the record appears otherwise, the company has been a leader in the effort to operate "unseen, unheard, and unsmelled" refineries.

The explanation offered was: "As we encourage the public to notify us if they feel we are at fault, the relatively large number of complaints each year and the lack of a decrease in recent years does not indicate we are a 'bad neighbor'; rather that we have been successful in getting nearby residents to notify us of **any** odors, no matter how small, which they think we may be emitting."

A similar comment came from an East Coast refiner in reporting three complaints during 1956, two in 1957, '58, and '59, and one in 1960:

"The refinery promptly and vigorously investigates atmospheric-pollution complaints from private citizens, using recorded climatic data to supplement direct investigations.

"In all of the cases listed, it was concluded that refinery operations were not responsible for the com-

COMPLAINTS RECEIVED BY 37 REFINERIES DURING THE PERIOD 1956-1960

District	No. plants	Number of complaints during 1956	1957	1958	1959	1960*
1	13	41	82	82	91	64
2	9	2	9	9	19	17
3	6	26	9	7	9	9
4	1	2	0	3	2	4
5	8	34	73	95	87	73
Total	37	105	173	196	208	167

*First 10 months only.

plaint. However, we feel that prompt and vigorous investigations are vital to maintenance of good public relations in regard to pollution control."

A third example is the experience of a New Jersey refinery. Located in a highly industrialized area near New York City, its complaint record was: 12 in 1936, 31 during 1957, 17 in 1958, 34 in 1959, and 19 in 1960. Yet the plant is one of the most odor-free plants on the East Coast.

The refiner's explanation was:

"The data supplied (on complaints) indicate the growing awareness on the part of the general public of air-pollution problems, and possibly a more critical appraisal of incidents involving pollution.

"We are glad to find, in the statistics we maintain on complaints by nearby residents, that the number of incidents for which our plant was directly responsible has steadily declined during the same period, and now represents a very small portion of total complaints.

Handling complaints. Another point covered in the survey was the methods used to prove that a plant was not the source of an odor when faced with a complaint from residents or pollution control authorities.

Here again the replies varied according to the severity of the air-pollution problem in the area where the plant was located. In general, however, refiners now are thoroughly convinced of the need for prompt investigation of all complaints.

To assist them in their dealings with residents and APC officials, nearly all large plants now keep records of wind velocities and direction. These, supplemented by summary sheets reflecting any upsets, usually are sufficient to prove that the plant was not (or was) the source of odor.

Extent to which some refiners monitor plant operations is reflected in the statements of two refiners. A New Jersey refiner said:

"We recognize the value of smooth operational continuity as a primary means of avoiding unit upsets which lead to pollution-control problems — flaring, smoking furnaces, safety-valve losses, etc.

"However, when upsets do occur, we have designated shift foremen as conservation - control coordinators. They immediately take all practical steps to minimize the pollution effects of the upset.

"Tools and data used by these coordinators include an SO_2 recorder, meteorological reports, refinery-operations summaries, a noise-level recorder, and explositivity meters and ultraviolet lamps to check sewer conditions. Data from these reports and instruments are summarized in an air-conditions report for review daily by all refinery operating-division heads."

The refinery as a source of air pollution

Refining of petroleum is carried out entirely inside heaters, towers, and other vessels, lines, and tankage. Good practice dictates that leakage and evaporation losses of valuable hydrocarbons be held to a minimum. But even with perfect housekeeping, there always will be up-the-stack losses.

Potentially a refinery can release many pollutants into the air. The types of emissions, and their sources, which can come from a plant are listed below.*

Just how much of these contaminants will be released depends upon many factors. The age of the refinery, type of processes used, type of crude handled, and the products manufactured all effect the amount and type of emissions. In addition, there are the factors of size, extent to which APC is carried out, and whether the housekeeping is good or bad.

From these many variables, it is readily evident that the quantity and types of emissions will not be the same for all plants. Detailed studies carried out at one plant will show certain amounts of hydrocarbons, sulfur compounds, and other pollutants are escaping into the air. But a nearby plant of the same size may present entirely different data.

The need for control presents just as many variables. Location, topography, wind velocities and direction, frequency of temperature inversions, and other factors influence the control needed. They may be relatively simple. Conditions rarely require corrective measures such as those adopted in Los Angeles refineries.

Emission	Potential Sources
Oxides of sulfur	Boilers, process heaters, catalytic cracking unit regenerators, treating units, H_2S flares, decoking operations.
Hydrocarbons	Loading facilities, turnarounds, sampling, storage tanks, waste water separators, blow-down systems, catalyst regenerators, pumps, valves, blind changing, cooling towers, vacuum jets, barometric condensers, air-blowing, high-pressure equipment handling volatile hydrocarbons, process heaters, boilers, compressor engines.
Oxides of nitrogen	Process heaters, boilers, compressor engines, catalyst regenerators, flares.
Particulate matter	Catalyst regenerators, boilers, process heaters, decoking operations, incinerators.
Odors	Treating units (air-blowing, steam-blowing), drains, tank vents, barometric condenser sumps, waste-water separators.
Carbon monoxide	Catalyst regeneration, decoking, compressor engines, incinerators.

*Source: Public Health Service Publication No. 763, "Atmospheric Emissions from Petroleum Refineries."

A Texas refiner reported the following technique:

"The complaint is investigated immediately by qualified investigators who are on call day or night. He has at his disposal hourly records of wind direction and velocity. Also a continuous record of the oxidizable sulfur compounds (principally H_2S and SO_2) is obtained by monitoring with a Titrilog. This unit is portable and can be used to check concentrations in nearby residential areas.

"Paint panels with lead-base and fume-resistant paint sections also are located on the perimeter of the refinery to detect the presence of hydrogen sulfide."

Methods used by two Los Angeles plants were: "Wind-recorder charts, fall-out monitoring plates, daily reports of hourly checks on smoke and odors by strategically located personnel."

The second reported: "This refinery maintains records of wind direction and velocity, atmospheric concentration of SO_2 at ground level, observations of a daily odor control, process data, maintenance work done, and smoke and dust-detection devices."

Role of Research

Much has been learned about the fundamentals of air pollution in the past 10 years. But insofar as the chemistry and mechanics are concerned—not to mention the effects of air pollution on human health — much more needs to be learned if community problems are to be solved on an intelligent basis.

That air pollution is a growing urban problem is readily reflected in the tone and quality of articles carried in newspapers and national consumer magazines. Here are just a few examples:

"Filth in the Air," Redbook, April 1960.

"The Polluted Air We Breathe," Consumer's Union, August 1960.

"How Much Poison Are You Breathing?" Harpers Magazine, October 1960.

"The Filthy Air We Breathe," Changing Times, September 1960.

"The Noisome Problem of Car Fumes," Fortune Magazine, January 1960.

The Consumer's Union article received wide newspaper publicity due to a listing of the 12 worst-polluted areas in the United States. Based on a poll of APC experts the areas were: New York, Chicago, Los Angeles, Philadelphia, Cincinnati, Detroit, St. Louis, Birmingham, the Ohio River Valley, Pennsylvania's Allegheny County, the Kanawha Valley of West Virginia, and the area around Niagara Falls, N. Y.

With half our population now living in 174 metropolitan areas, practically every major city now has air-pollution problems. Many are making surveys and taking steps to correct the situation.

Regardless of the extent to which

No article on air pollution would be complete without some reference to the role played by the automobile in producing Los Angeles-type smog, and the process being made toward a cure.

Los Angeles, which probably has the most stagnant air of any major U. S. city, was the first place where smog became a problem. But as their car populations increase, other cities are experiencing similar attacks. San Francisco, New York, and Chicago all have eye-burning smog during periods of static weather.

In Washington, D. C., last fall, smog reduced visibility to 1.5 miles, as compared to 10 miles on a clear day. At the peak an ozone concentration of 0.25 p.p.m. was measured, only half that at which the first alert is called in Los Angeles.

There no longer appears to be any question that the auto is the main cause. Researchers can create "synthetic" smog by irradiating exhaust gases in the laboratory, producing formaldehyde, acrolein, and peroxyacetyl nitrate—three compounds which have been found to have eye-burning, crop-damaging properties.

Effect of fuel composition. With the cause of smog now apparently determined, the best means of cleaning up the exhaust gases is now the goal. Most researchers believe that either catalytic converters or direct-flame afterburners will be the answer. Some, however, believe a partial solution is to limit the olefin content of motor fuels.

Though the relationship between fuel composition and an auto's exhaust is far from settled, research conducted by the Bureau of Mines at its Bartlesville, Okla., laboratories indicates little can be accomplished by this route.

The bureau has found that only during decelerating periods does the olefin concentration of the exhaust follow the olefin content of the fuel. During accelerating and cruising, the olefin content of the exhaust was independent of the fuel's olefin content.

Even more important, the majority of its experimental data shows a slight trend toward decreased olefin emissions with higher olefinic content of the fuel.

Research by the Los Angeles Air Pollution Control District points to the opposite conclusion. Fuels with different proportions of olefinic, paraffinic, and aromatic fractions were tested under average Los Angeles traffic conditions. Analysis of the exhaust gases showed their hydrocarbon composition reflected the composition of the parent fuel.

Meanwhile, the APCD's Rule 63, which became effective last July 1, prohibits the sale of gasolines having more than 15% olefins. The limit may be further reduced to 10% in mid-1962. At least two Los Angeles refiners have found it necessary to install light hydrogen-treating units in order to comply with the existing limit.

The search for a converter. With a California state law already setting standards for motor-vehicle exhaust emissions, the job is to develop devices which will effectively (and economically) reduce their hydrocarbon and carbon monoxide content.

"Learning more about our atmosphere has been expensive"

refining operations may be contributing to air pollution in any of these cities, the petroleum industry—at least in the public's viewpoint—is indirectly involved since it supplies the motor fuel for autos.

Hydrocarbons, carbon monoxide, and lead exhausted from cars are becoming of increased concern to health authorities. Eye-burning smog is generally associated with Los Angeles; but New York, Chicago, San Francisco, Washington, and other large cities also are experiencing such attacks (see box).

Oil industry research. The oil industry has been one of the most active leaders in air-pollution research, both in the sponsorship of group research as well as that carried on privately. The American Petroleum Institute, Western Oil & Gas Association, Coordinating Research Council, and Air Pollution Foundation all have contributed valuable findings.

A 3-year study of Los Angeles refineries, completed in 1958, resulted in valuable data on refinery emissions and better sampling and analytical methods. Though it was a joint federal-state-county project, oil-industry personnel contributed much to its success.

Learning more about our atmosphere, and the extent to which refinery operations and products contribute to community air-pollution problems has been expensive. Complete figures are not available, but the following is a partial listing of oil-industry expenditures for research:

... API sponsored projects have cost more than $1,500,000. These approximated $250,000 annually during some years, and for the current year will be about $165,000.

... Western Oil & Gas has spent about $250,000 on surveys and in sponsoring research. Its member companies contributed another $1,275,000 to the Air Pollution Foundation during the period 1954-1960. Except for last year, when $75,000 was given, the annual contribution was $200,000. With its mission accomplished, the foundation is being dissolved this year.

... Oil-company research amounts to more than $500,000 annually, according to figures supplied the Journal in this survey. Even though many companies did not supply this information, the 16 which did reported a total of $526,000 annually during 1958-60. This year they planned to spend $503,000.

Based on the reported figures alone, it thus is evident that the oil industry's total research bill is ap-

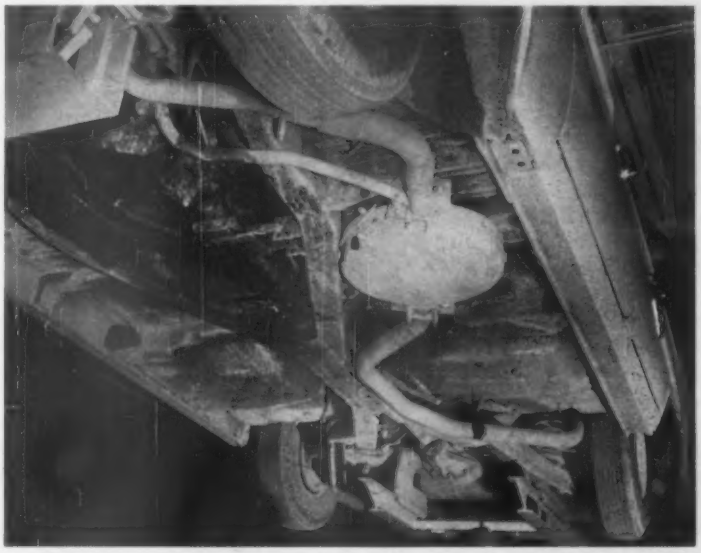
Facilities for testing such devices are now being set up in Los Angeles by the Motor Vehicle Pollution Control Board. When these are available, it is expected that several immediately will be offered.

Both Universal Oil Products Co. and Oxy-Catalyst, Inc., have catalytic converters which they claim will meet California requirements (i.e., capable of an 80% reduction in hydrocarbons and a 60% reduction in CO emissions, and that its initial cost be not more than about $50 above the cost of the existing muffler it would replace).

In the direct-flame afterburner field, Holley Carburetor Co. and Thompson Ramo Wooldridge, Inc., claim satisfactory devices. These are only 4 of the more than 30 companies which have been working on the problem.

Just when the first exhaust-control devices will be available is questionable. After the test facilities are set up, two or more devices have to be certified. A year after that any new car sold in California must have a converter before it can be registered. Thus it would appear that it will be about 2 years before any devices could appear on cars.

When completely satisfactory devices become available, it's not unlikely they will become standard equipment on all autos. The need for cleaner air will require their installation, pollution experts claim.



EXHAUST-CONTROL DEVICES are now in the mill which would reduce hydrocarbon and CO emissions considerably. Pictured is the catalytic converter developed jointly by Universal Oil Products Co. and Oxy-Catalyst, Inc.

proximately $1,000,000 annually.

The effort all industries are making is reflected in the total bill for research. According to Public Health Service estimates, about $11,000,000 was spent last year. Of this total about $4,000,000 was spent by industry, $5,000,000 by the Public Health Service, and about $2,000,000 by states and communities.

None of the oil-industry research expenditures include those spent to develop catalysts and converters for purifying automobile exhausts. Just how much was spent annually when the search was in the pure research stage is unknown because of the great secrecy involved.

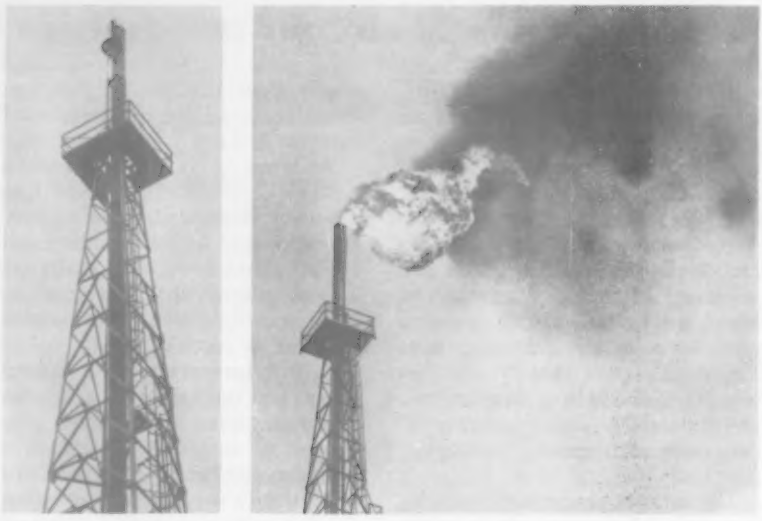
Research in this field now is below the level of some 2 years ago. The reason is that some potential manufacturers have left the research stage and are working on production prototypes (see box). Even so, one scientist closely affiliated with the problem placed current expenditures at more than $20,000,000 annually. This, however, is little more than an educated guess.

API research projects. Studies sponsored by the API Air and Water Conservation Committee (formerly Smoke and Fumes Committee) are carried out at various research laboratories under contract. The four projects sponsored this year, at a cost of $165,000, are:

... Chemistry of the air studies, centering around the reactions which result in the formation of Los Angeles-type smog. This project accounts for most of the research expenditure.

... Exhaust gas analysis, being carried on at the Bureau of Mines laboratory in Bartlesville, Okla. This project of the Coordinating Research Council (sponsored 40% by the oil industry) includes research to determine the extent to which fuel composition affects the olefin content of auto exhaust gases.

.. Plant damage caused by air pollution. The API contribution partially supports work carried out by University of California at Riverside. The program involves studying organic compounds formed in the atmosphere which cause damage to plants.



HERE'S A CONTRAST between smokeless burning and not-so-smokeless burning. Most smokeless flares use steam jets to mix air and gas thoroughly.

... A project to develop more technical information on pollution arising from the transportation, handling, refining, and storage of petroleum products.

From the nature of these projects it is evident the program is primarily basic research to explore the effects of air pollution on public health, industry, and agriculture. Only when these are better understood can abatement be carried out on an intelligent basis.

Public Health's program. After passage of Public Law 159 in 1955, the Public Health Service entered air-pollution research on a large scale. Among its activities have been the establishment of the Taft Sanitary Engineering Center at Cincinnati, setting up of an air-sampling network in more than 225 localities, and granting research funds to many universities and research institutions.

One of its projects is to assess the importance of air-borne lead, and its sources, on the health of the population. Positive correlations have been developed between traffic density and the lead and CO content of the atmosphere, pointing to the automobile exhaust as the source. In none of the work, however, has the CO or lead content approached concentrations held to be harmful to health.

PHS is now starting more extensive studies on auto emissions and their health effects. One phase will be to survey people, such as policemen, whose jobs expose them to heavy concentrations of auto exhausts.

... A stepped-up program of research, slanted toward the medical and health aspects of air pollution, was proposed last December by an advisory committee to the Surgeon General. It calls for research to be increased from the $11,000,000 current level to $32,000,000 in 1968.

Industry's role in the 10-goal program would be primarily to develop adequate and economical control methods, and to study emissions of individual industries.

Industry would supply about 27% of the funds, or about $8.5 million annually when the program is in full swing. The petroleum industry's share would be about $850,000 at that time, based on the ratio of its income to the gross national income.

Acknowledgement. Appreciation is expressed to the 56 oil companies which supplied the data on their air-pollution-control activities, and particularly to those whose comments added so much interest to the survey. Without this cooperation the survey would not have been possible.

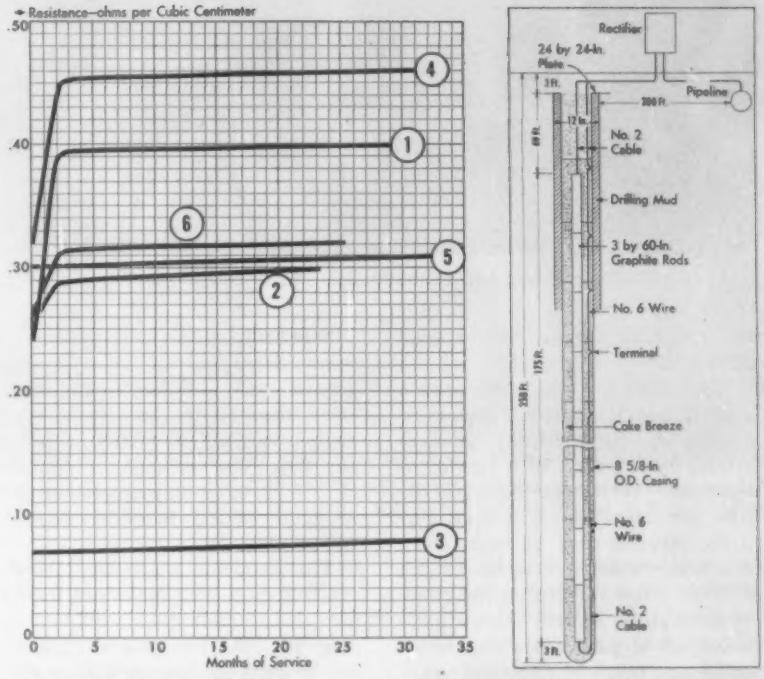
"PHS is starting more extensive study on auto emissions"

Lower, less-variable power needs favor deep ground beds

DEEP ground beds, in a majority of cases, provide a more satisfactory method of cathodically protecting bare pipelines than conventional beds. This is the conviction of corrosion engineers with Interstate Oil Pipe Line Co. after more than 3 years' experience and 30 installations.

This experience has led to some refinement and the standardization of techniques of installation. But, and most important, it has provided added proof that deep ground beds will usually protect more line with less trouble at lower cost than conventional ground beds.

Latest of Interstate's installations is protecting 23 miles of bare 6-in. line in southern Louisiana. The last of four ground beds was installed in late December. Two were put in a few miles from either end of the protected section and the others at approximately 5-mile intervals.



BRIEF RISE IN RESISTANCE of deep ground beds is followed by stable condition as shown in Fig. 1 (left). Standard method of installing deep ground beds as followed by Interstate Oil Pipe Line Co. is shown in Fig. 2 (right).

BY JOHN P. O'DONNELL
Assistant Pipeline Editor

Low power cost. Probably the greatest single advantage of the deep ground bed is its lower and less variable use of power. Much lower power costs mean correspondingly lower operating costs. And the absence of variations makes it possible to more closely match the capacity of the rectifier with the requirements of the system.

Power requirements of deep ground beds are low because they are located in low-resistance soil. Resistance generally decreases with depth and the top of the column of anodes is 70-75 ft. below the surface. Here, for example, are the resistances in ohms per cubic centimeter found in the four deep ground beds installed on the south Louisiana line.

Depth	No. 1	No. 2	No. 3	No. 4
50 ft.	5.6	3.6	5.2	2.8
100 ft.	3.8	3.0	4.5	2.1
150 ft.	0.59	1.1	0.72	0.76
250 ft.	0.40	0.64	0.45	0.41

Not only are soil resistances lower at greater depths but they are also less variable. Since they are deep, these ground beds are not subject to conditions, such as heavy rainfall, that can materially affect resistance near the surface. The rectifier, therefore, can be more accurately matched to the needs of the system. Both oversizing the rectifier to meet occasional peak requirements or undersizing with the possibility of not being able to meet peak demands are obviated.

Resistance rise. While deep ground beds are not subject to variation, they do tend to increase in resistance. Fig. 1 shows the experience encountered in six older installations. These have been in service from 2 to 2½ years. Four (2, 3, 5, 6) showed very little increase. Two (1, 4) showed sharp proportionate increases but, even at their peak, were far less than the resistances near the surface at the same sites.

The tendency of soil resistance to rise in the vicinity of deep ground beds is believed to be a result of the migration of moisture from the ground bed. When this migration ceases and conditions surrounding the ground bed become stable, resistance also stabilizes.

The first deep ground beds were frequently installed within the right-of-way and, in one instance, between parallel lines. Since then it has been found that lateral as well as vertical distance improves efficiency. Now Interstate makes it a practice, wherever possible, to locate them as much as 200 ft. from the pipeline. This distance is comparable to that used with conventional ground beds.

Survey's role. Less extensive soil surveys are needed in locating deep ground beds. The object of the surveys is to locate a layer of low-resistance soil beneath the top layer of high-resistance soil. So, while surveys are needed to get all or as much as possible of the ground bed in low-resistance soil, this is more easily done than determining the

GRAPHITE ANODES ARE COUPLED into 175-ft. continuous unit with threaded couplings. Figs. 3A and 3B.

best location for a conventional ground bed.

Since the top, high-resistance layer is usually not as deep as it is wide, the current from the deep ground bed has less of a barrier to penetrate. While the full 200 ft. from the conventional ground bed to the pipeline may be high-resistance soil, its depth may be but 50 or 70 ft. Thus the current originating deep in the ground has a 50-70-ft. barrier to pass while that originating just below the surface has a 200-ft. barrier.

In passing from low to high-resistance soil, the current has a tendency to deploy as it seeks the path of least resistance. This tendency accounts, in part, for the ability of the deep ground bed to protect a greater length of line pipe.

Standardization. Interstate has standardized its installation of deep ground beds. Actual installation, after the 12-in. hole has been drilled, can be completed in a single day. The installation consists of 175 ft. of 3-in.-diameter graphite anode in 250 ft. of 8⅝-in.-o.d. casing (Fig. 2).

The anode is made up of 5-ft. graphite bars with male and female threaded couplings at either end (Fig. 3A, 3B). The ends of each bar are beveled for sealing with a special resin cement. Before being installed, the bars are made up in 15-ft. lengths to correspond with the 15-ft. casing sections.

Each section of the used casing has lugs welded to opposite sides at one end, has a threaded terminal welded just inside the same end, and is strip coated (Fig. 4). The outside lugs make it possible to handle the casing with lifting bails. The terminals are used to connect a No. 6 wire from section to section to insure continuity from top to bottom. The wire for each section is attached to the terminal before installation.

Strip coating. The casing strings are strip-coated for their entire length with a 2-in. band of coal-tar enamel. A form for the strip is made by stretching parallel lengths of sash cord from end to end (Fig. 5). The lengths of cord are about 2 in. apart and enamel is poured in the intervening space, making a strip about 3/16-in. thick.

This coating insures a continuous strip of metal from the top to the

CASING IS PREPARED with outside lugs, inside terminal and is strip coated before use. Fig. 4.

STRIP OF COAL-TAR ENAMEL is applied to help insure uniform disintegration of casing. Fig. 5.

CHUTE FITS INTO CASING and around anode for regular distribution of coke breeze as it is dumped from bags. Fig. 6.

bottom of the casing even if excessive corrosion occurs at one or more points. Such corrosion would otherwise part the casing and prevent its uniform disintegration.

Thus the casing serves not only as a means of placing the graphite anode but also serves as a sacrificial anode. The wire bonding and the coal-tar strip, both running the full length of the casing, assure its total dissipation, leaving the graphite anode for continued service.

Resin seal used. When the graphite bars are assembled into the 15-ft. lengths, the joints are sealed with a resin cement that is compatible with the graphite. After sealing, the joints are wound with tape.

The casing and graphite anode go into the hole simultaneously. The first anode assembly uses the rod with the No. 2 cable at the base. Enough coke is dumped into the 18-ft., plugged bottom string so that the anode will protrude from the top. The 15-ft. graphite anode is then set in the casing and the cable from its base connected to the terminal at the top of the string.

The annular space between the anode and casing is filled with coke breeze. The coke is dumped from bags into a chute which distributes it around the anode (Fig. 6). The string is then weighted with water and lowered into the hole.

Strip continued. After the next section of the casing and anode are lifted into place, the anode sections are screwed together, coated, and taped; the No. 6 wire of the second section is connected to the terminal of the casing in place and the joint welded. The casing is coated around the weld with the coating so applied that the strip is continued from section to section.

This procedure is repeated with the 15-ft. sections of casing and anode until the 175 ft. of graphite rods are in place. The topmost anode has a pigtail of 0/2 cable which is spliced to the cable leading to the rectifier. The terminal in the topmost string of casing is similarly spliced. These splices are wrapped with four coats of tape over a coat of mastic seal for the utmost in protection.

The final three sections of 22-ft. casing are added, each successively filled with coke and weighted with water. The final step is welding a 24-in.-square plate at the top of the last string of casing to insure that the casing will not slip in the hole and break the cables.

Initial cost higher. Deep ground beds installed in this manner are considerably more expensive in first cost than conventional ground beds. The total installed cost including rectifier is approximately $3,200 for a 550-amp. unit compared to an estimated $2,200 for a comparable conventional bed. On the basis of these figures, Interstate is protecting 291 miles of pipeline, either bare or with coating so bad it is considered bare, at an installation cost of $330 per mile.

While higher in installation cost, the much lower power consumption and greater range of the deep ground bed made it much less costly to operate.

The savings in operating costs offset the higher installation costs.

Interstate will continue to use conventional ground beds where the pipe is well coated, where little current is required, and where the soil is of low resistance. It has replaced conventional with deep ground beds in only a few instances where the resistance was too high for conventional beds. But, when the pipe is bare or when current is the range of 25 to 100 amp. is needed, it will rely on the proven performance of deep ground beds.

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New design boosts alkylate quality

New Perco unit makes 106.5 leaded-motor-octane debutanized alkylate when operating on mixed propylene-butylene feed.

BY W. F. VERNON AND C. E. BAECHLER
Phillips Petroleum Co.,
Kansas City, Kans.

A NEW HF alkylation unit, now on stream at Phillips Petroleum Co.'s Kansas City, Kans., refinery, incorporates some of the latest thinking in the design of such plants.

Some of the significant features of the 6,000-bbl. motor-fuel unit include:

- **Newly developed** reactor-settler system which improves alkylate quality and greatly reduces production of acid-soluble oils.
- **Operation** at an isobutane-to-olefin ratio of 15:1.
- **Depropanizer** and deisobutanizer are operated in parallel.

Flow diagram of the unit is shown in Fig. 1.

Process flow. Olefin feed from the treated-feed surge tank is processed through a feed depropanizer and the feed deethanizer to remove ethane. The deethanized feed is dried, mixed with recycle isobutane, and dispersed in the acid phase in the reactor. Reaction temperature may be varied between 70° and 100° F., depending on the available cooling-water temperature and supply.

Hydrocarbon effluent from the reactor system is charged to both the depropanizer and isostripper, with about one-third of the total volume going through the depropanizer to remove propane from the system.

Depropanizer overhead is charged to a stripper to remove HF from the propane product. Depropanizer bottoms, after heat exchange with the depropanizer feed, are returned to the isostripper.

The isostripper takes isobutane from the bottoms product, and at the same time maintains recycle isobutane purity. Dried makeup isobutane is brought into the isostripper accumulator for a faster response to changes in isobutane consumption in the alkylation reaction.

Thermal defluorination of the products is achieved by the use of a fired reboiler on the isostripper. This reboiler also supplies reboiler heat for the depropanizer by heat exchange with the fired-reboiler effluent. Motor-fuel alkylate is debutanized and sent to storage.

The unit was designed to alkylate a mixed propylene - butylene feed from the fluid catalytic cracking unit. Outside isobutane is supplied from Phillips' natural - gasoline facilities by batch tenders via the products pipeline between Borger, Tex., and Kansas City, Kans.

Table 1 shows the charge composition of a typical propylene-butylene feed stock. Table 2 shows average properties of debutanized alkylate from the two operations.

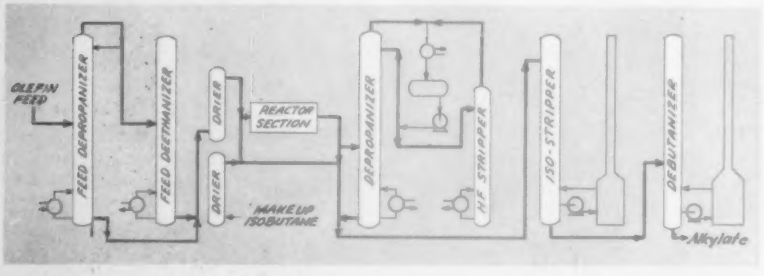
Many of the facilities which were part of a shutdown cat poly unit were used in the construction of the alky plant. The cat poly control room was renovated and is now used as the alkylation control room. Other cat poly facilities which were converted included the olefin-feed-treating facilities (amine and caustic treaters), feed surge tanks, and three fractionators (feed depropanizer, feed deethanizer, and alkylate debutanizer).

TABLE 1—TYPICAL CHARGE-STOCK COMPOSITION

	Butylenes operation	Propylene-butylenes mixed-feed operation
Olefin feed, LV %:		
Propylene	0.8	16.5
Propane	1.5	12.9
Butylenes	47.6	28.0
Isobutane	36.6	25.9
n-Butane	11.2	9.2
Pentenes	...	2.8
Isopentane	2.2	4.4
Pentanes plus	0.1	0.3
Isobutane - olefin ratio	15.0	15.0
Barrels alkylate-barrel olefin	1.76	1.76
Barrels isobutane-barrel olefin	1.12	1.24

TABLE 2—TYPICAL PROPERTIES OF DEBUTANIZED ALKYLATE

	Butylenes operation	Propylene-butylenes mixed-feed operation
°API	70.1	71.1
R.v.p.	4.70	4.9
ASTM distillation:		
I.b.p.	118	113
5%	165	153
10%	187	170
20%	207	188
30%	214	201
40%	218	208
50%	220	213
60%	222	217
70%	224	221
80%	227	231
90%	236	253
95%	256	295
End point	368	375
Rec. %	98.0	98.2
RON clear	96.0	93.8
+3 cc.	107.8	105.0
MON clear	94.0	91.7
+3 cc.	108.3	106.5



GREAT SAVINGS can be realized on this size unit by splitting the flow between deisobutanizer and depropanizer. Fig. 1.

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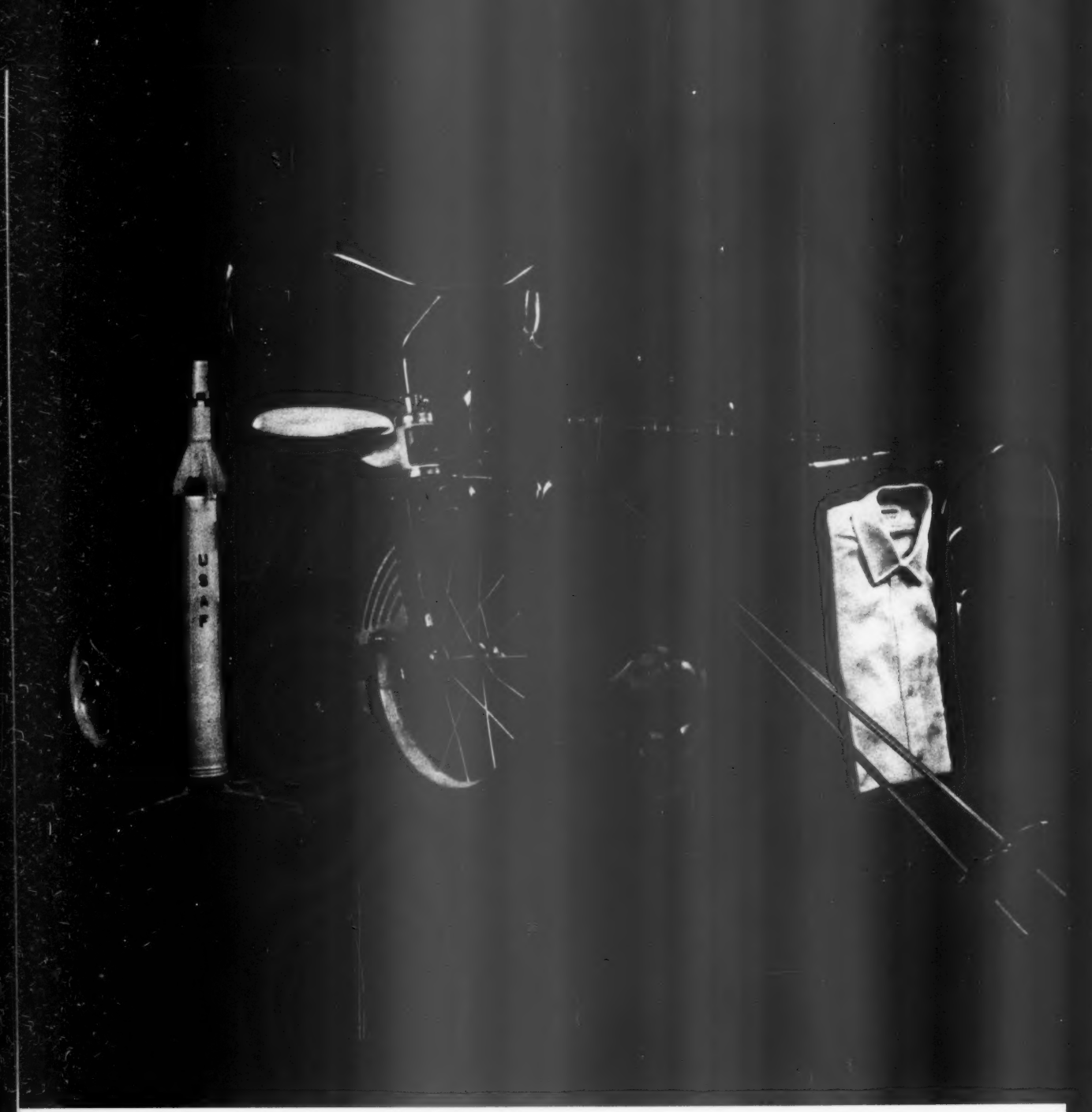

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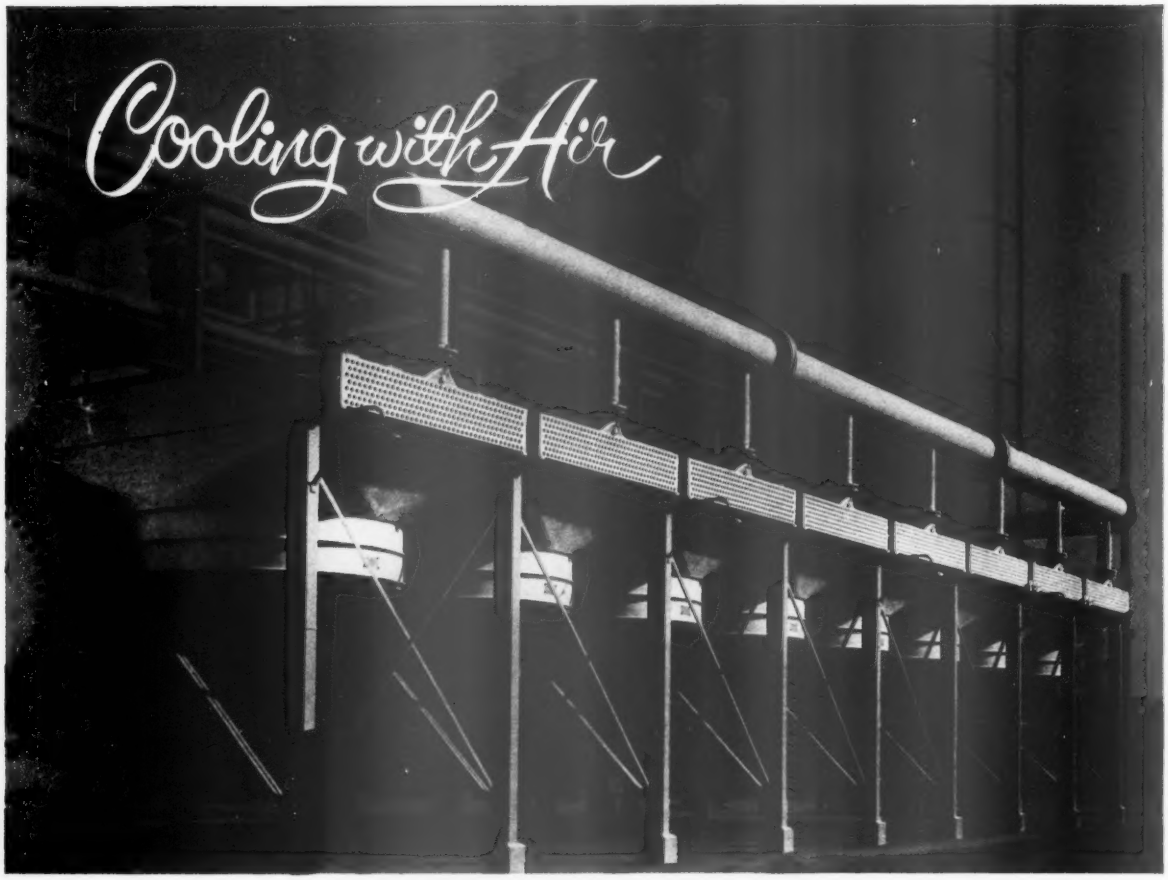

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Let's apply the know-how we have to

FOAM AGENTS and FOAM DRILLING

BY A. S. MURRAY
AND J. E. ECKEL
Jersey Production Research Co.
Tulsa

For instance . . .

- Foam drilling can handle larger flows of formation water than is generally realized.
- Successful foam drilling needs constant presence of skilled drilling personnel to collect and evaluate data so that techniques can be improved on successive jobs.
- Foam drilling, like mud drilling, requires careful evaluation of fluid-flow properties and the injection of precise amounts of additives at controlled rates.
- Air-drilling-technology schools are needed.
- There is need for a standard test for screening all foaming agents on a common basis.
- Research studies should be conducted to find out more about the lifting-capacity requirements and flow characteristics of a two-phase flow system under borehole conditions.

FOAM DRILLING is only one modification of air drilling.

But its importance is growing.

Successful foam drilling depends on an efficient foaming agent—one that has the properties needed to get the job done. This article deals with these requirements of a foaming agent, and other aspects of foam drilling.

From experience, operators realize that air drilling in general has these advantages: (1) improved definition of stratigraphy and structure, (2) more and usually better well data, and (3) two to ten times the penetration rate and bit life.

Dry formations are usually drilled with only air as a circulation medium. But when other conditions are present, the drilling fluid must be modified in these ways: (1) Foam drilling is used to penetrate competent water-bearing formations, (2) aeration drilling is used to penetrate less-competent formations that can be drilled with foam, and to lift large flows of formation water, and (3) chemicals are used to shut off flows from water-bearing formations.

Let's define terms. Injection of a foaming agent or the simultaneous injection of foaming agent-water mixture into the air stream, making a two-phase fluid system in which air is the primary phase is called **foam drilling.** The term **"mist"** drilling, which has been widely used by industry for several years, has been dropped from our nomenclature. It is used by hydraulics engineers to define a specific type of flow that bears no similarity to flow conditions in a hole drilled with airfoam and water.

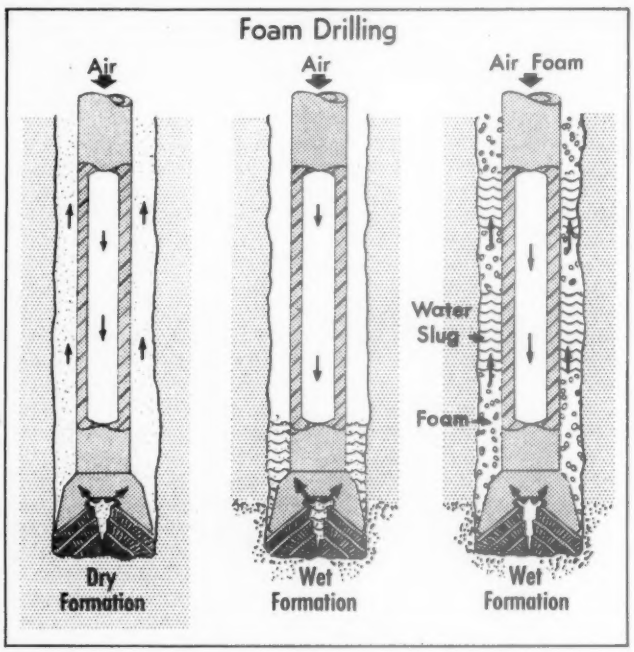
Simultaneous injection of mud and air into a well bore, in which mud is the primary phase, is **aeration drilling.** (Generally "mud" refers to a saturated lime water).

A rock formation that will not slough into the well bore under hydrostatic well bore pressures, or under the conditions imposed by air, foam, or aeration-drilling procedures is a **competent formation.** Specifically, a competent formation has the ability to withstand water contact without sloughing.

What happens downhole. When wet formation is drilled, cuttings bridge and ball in the well bore and air alone will not disperse and remove them. At one time, slugs of water or drilling mud were used to disperse the wet cuttings. But this required high-pressure air and almost continuous slugging. This slugging technique was replaced by continuous injection of a foaming agent or a mixture of foaming agent and water (foam drilling) into the air stream. This has several advantages: (1) Wet cuttings can be removed from the hole with less pressure, (2) there is less sloughing of the well bore since borehole pressure is more stabilized, (3) because borehole pressure is more stabilized and lower, penetration rate and bit footage are improved.

Generally, if the formation-water flow is sufficient to disperse the cuttings, foaming agent is continuously injected with only enough water to carry the foam to the bit. Conversely, if there is not enough formation water to disperse the cuttings, more water is added at the surface along with the foam.

Maintaining a good foam insures



Foaming agents create gas-lift effect

DRY FORMATIONS can be drilled with only air as a circulating medium. But when drilling in a water-bearing formation, the hydrostatic head of water collecting in the borehole can easily exceed the pressure of the air in the hole, as shown in the center drawing. This is where foaming agents help. By creating a foam, the column is lightened, and the available air pressure can lift the water from the hole. Studies have shown that the flow in the annulus is probably slug flow as shown on the right.

complete hole cleaning. Normally 3-5 gal. of foaming agent in 10 bbl. of water will produce a good foam; injection rate will vary from 1-2 bbl. of the mixture per hour to 1 bbl. per minute on special occasions. Foam concentration and water-foam injection rate will depend on lithology, well depth, formation-water influx rate, and penetration rate.

Role of formation water. Up until 4 years ago, control of formation-water influx into the well bore limited air alone to dry formation drilling. Now, as a result of laboratory and field studies, formation water can be handled in competent formations by foam drilling, aeration drilling, and use of water-shut-off chemicals, as previously described. These procedures have extended air and gas circulation to many other applications where foaming agents are used—drilling lost-circulation zones and seismic shot holes, completing and working over wells, and percussion drilling.

Here's the problem. Many misconceptions have crept into our technology and have prevented wide-scale investigations and full acceptance of the air-drilling technique. Misconceptions about air-drilling practices can only be eliminated through close analysis and continuous observation of daily operating procedure.

Appraisal of foaming agents

Many questions about foam and foam procedures remain unanswered. Some of these are:

- How stable a foam do we need?
- Is foam broken down by rough borehole configurations?
- What bubble size and total volume are required for optimum results?
- How do bentonitic clays and shales affect foam stability and volume?
- How effective is an air-foam-water mixture in removing cuttings, or cuttings and water, from a well bore?
- What are the flow characteristics of an air-foam-water mixture in the well bore?

Only additional experience and research can completely answer these questions. But, on the basis of what has been learned about foam drilling in the last few years, a few suggestions can be made.

Operating, service, and chemical-manufacturing personnel need to set up a standard dynamic test for evaluating all foaming agents on a common basis. Test conditions should closely simulate borehole conditions in which an air-foam-water circulation system is used. Best foam test available today is the one developed by Dunning, Eakin, Reinhardt, and Walker, of the U. S. Bureau of Mines at Bartlesville, Okla.[1]

We need a foaming agent that is readily soluble in cold water. Until one is developed, a freezing-point depressant should be used. Most foaming agents thicken or solidify at temperatures below 35° F., so special facilities, such as steam coils in the mixing tank, are needed to insure a good mix.

The oil industry needs effective, cheap, foaming agents that will react well in both fresh water and brine. So far as is known, there are no commercially available agents that will foam equally well in fresh and salt water and meet our requirements. It is important to have a dual-purpose foamer because (1) there would be no possibility of using the wrong type, and (2) transportation costs would be reduced if there were just one type of foaming agent to haul.

Every effort should be made to keep the cost of foam to a minimum. Since foam usually makes only one pass through the borehole, the oil industry cannot afford to use it if the foaming agent costs more than 30 cents per pound ($3.25 per gallon). Several currently available fresh-water agents costing from 17

to 30 cents per pound ($2.00 to $3.25 per gallon) have been satisfactory.

The higher cost of some foaming agents has resulted largely from marketing practice. These costs can be kept down if:

1. Air service companies who handle foaming agents do so largely as a service to their air customers. This would mean selling the agents at cost plus a reasonable handling charge.

2. Chemical manufacturers who have no direct outlets in the oil fields do not market their products through expensive dealerships whose costs are passed on to the consumer in the form of excessively high foam costs.

3. Chemical manufacturers and operating oil companies who cooperate in developing improved foaming agents will market them at cost plus a reasonable profit. Although this kind of cooperation is commendable, there has been a tendency to add too high a development charge, thus limiting the use of these agents.

Foam-Injection Procedure

Foam drilling must be carried out carefully and precisely if optimum results are to be obtained. Borehole hydraulics and lifting capacity of this system are complex and not fully understood. As yet, optimum procedures have not been developed, and research studies are needed to better define these parameters. Principal object of foam drilling is to remove wet cuttings and formation water from a well bore with the lowest possible borehole pressure. To do this these rules must be observed:

Always observe blowline returns, the pressure recorder, the weight indicator, and the log of drilling time. This practice gives information equivalent to that obtained by measuring properties of drilling mud. In both cases, the purpose is the same: to determine if the circulating medium is cleaning the hole of cuttings and providing optimum bit hydraulics.

Supervise the first two or three air-drilling jobs continuously. Keep complete records, and carefully evaluate the results. This should make it possible to conduct subsequent air drilling on a more routine basis and to improve techniques.

Find the optimum injection rate and foam concentraton, keeping in mind that hole conditions may change rapidly because of changes in hole diameter, lithology, water influx rate, and depth. Equally important, make sure that the drilling crews maintain the prescribed injection rate and concentration. From observations of foam-injection equipment and technique employed by numerous service companies and operators, it is apparent that there is little appreciation of the precise procedures needed in injecting a foaming agent and in evaluating results.

Before starting the job, rig up with the necessary injection pumps, stockpile foaming agents on location, and provide adequate booster capacity to meet unusual air-pressure requirements. Don't wait for wet drilling before doing this, since formation water is present in almost 95% of drilling operations. Many air-drilling jobs have failed because not enough equipment was available or because it was not properly designed to meet the worst borehole operating conditions.

Educate operators, contractors, and service personnel in foam drilling to be sure that they can always follow optimum procedure.

To be sure that foam drilling attains its objectives, supervisory personnel at the well site should have a general understanding of:

1. Air-volume requirements for different hole sizes.

2. Fluid-flow characteristics of a two-phase system.

3. How to improve the lifting capacity of an air-foam-water system.

4. The probable depth at which formation water will be encountered, and its influx rate.

5. The lithology, which affects cuttings size.

6. How much the hole will wash out and how much of the interval the washout will cover.

7. The penetration rate expected through various formations.

Let's look at some of these, one at a time.

Air-volume requirements. Until recently the amount of air needed to drill a hole was estimated on the basis of experience. Estimates of air requirements were put on a firmer basis when R. R. Angel, of Phillips Petroleum Co.,[2] modified formulas used in pipeline gas-flow measurement so that they would apply to specific air-drilling conditions. Although tables based on Angel's work are now widely used to determine air-volume requirements, there are two points that should be remembered:

1. The tables are valid only when **dry** formation is being drilled. In wet formation, the variable and complex flow conditions that develop within the well bore require more air. In wet formation, then, we need to observe circulation-pressure trends and blowline returns closely to see if all cuttings are being removed.

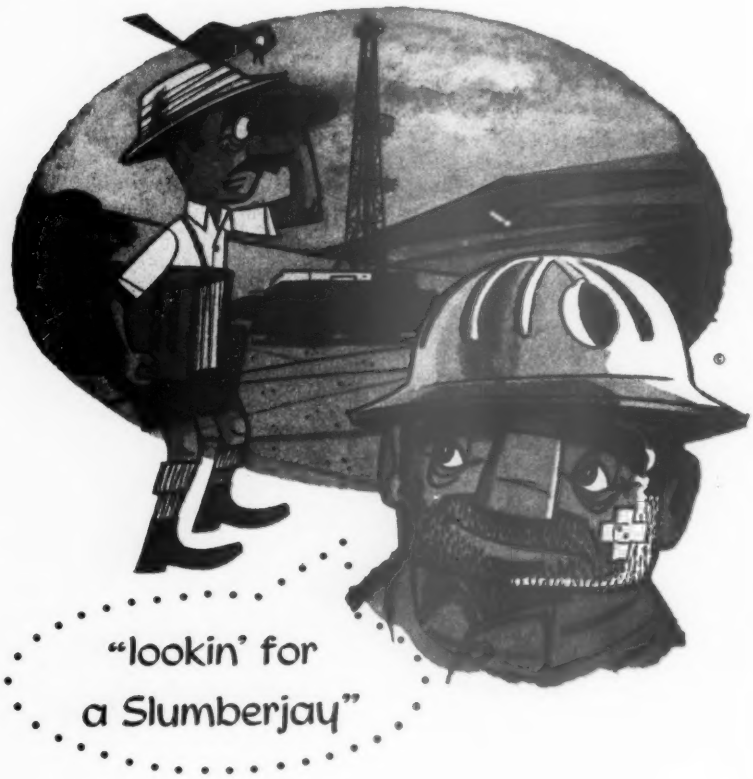
2. The tables are based on gage hole—that is, hole the same size as the bit that is drilling it. Experience has shown that unless the formation being drilled is very hard, the hole will wash out at least 2-3 in. (In one operation, a 9-in. hole washed out to 24 in. over a 300-ft. section.) Increased diameter naturally means more air for equal lifting capacity.

In summary, Angel's work is very valuable in planning air-drilling operations. But air-volume requirements based on his tables must be modified if increased lifting capacity is needed because of wet formations or increase in hole size. In some areas where operators have condemned the formations as being incompetent and not subject to air drilling, the true cause of failure has undoubtedly been lack of enough air to clean the hole of cuttings. Good practice requires an "oversupply" of air on every job to take care of these possibilities.

How much water can we tolerate? Whenever air-drilling personnel get together, one of the first questions discussed is "How much formation water can be economically handled with foam drilling?"

Our experience shows that it can economically handle larger flows than generally supposed. In competent formation, foam drilling is economical at water influx rates as high as 500 bbl. per hour, to a well depth of 4,000 ft. As drilling proceeds below that depth, the

Congrats and $25 for this quip to Mrs. Merlyn Goodman, Rt. 5, Box 742, Shreveport, La.



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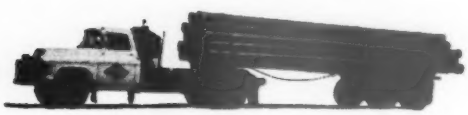

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amount of water influx that can be economically handled decreases gradually.

Opinions of other operators about the economics of foam drilling diverge widely since their views are based on different experiences. Rarely do two operators drill where lithology, well depth, air supply, foam-drilling procedures, and water-influx rate are similar. Also, many operators have failed to lift water and clean the hole of cuttings because of inadequate foam concentration and volume, air volume, and booster capacity. And, in numerous cases, they have lacked proper equipment for injecting foam or a foam-water mixture under the conditions existing in the borehole.

Economics of foam drilling can sometimes be improved by reinjecting blow-pit water, which contains a high concentration of foaming agent. The water can be reactivated to the required foam concentration with only minor additions of foaming agent. This has been done to reduce foam costs and to save water in areas where water is scarce.

Some operators are using slugs of foam-water mixture to unload (get wet cuttings and water out of a hole) a hole **while drilling.** This procedure is not recommended because it has two undesirable results: (1) High borehole pressure caused by the slugging process decreases the penetration rate, and (2) high annular velocity resulting from slugging increases erosion of the borehole and may cause sloughing.

However, slugging of high concentrations of foaming agent in water is often recommended for raising large volumes of water that may accumulate in the hole while circulation is discontinued for changing bit, making repairs, etc.

Cuttings size. In some air-drilled formations, cuttings recovered are too small for complete geological appraisal; in other formations, no cuttings are recovered at all. Extensive efforts to produce larger chips by adjusting drilling variables such as bit weight and table speed have not been too successful. This would be expected, for two reasons: (1) Cuttings are naturally small when hard-formation rock bits and tungsten carbide insert bits are

used, as they are in air drilling all types of formations, (2) in an air-drilled hole, cuttings are not as well protected against abrasion and impact as they are in a mud-filled hole.

One way to get chips to the surface intact is to insure **continuous** flow of cuttings, water, and air. It is our observation that in the average foam-drilling operation, where the emphasis is on an economy job, air volume, foam volume and concentration, and injection rate have not been adequate to lift cuttings from the bottom of the hole without surging them two or three times. These surges expose the cuttings to repeated grinding action by the drill pipe and the well bore until they are small enough to be removed by the circulation medium. To avoid these surges and to obtain as large a chip as possible, drilling should be constantly supervised to see that air or foam volume, foam concentration, and injection rate are modified as required by changes in hole gage, well depth, lithology, and water influx rate.

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1. Dunning, H. N., Eakin, J. L., Reinhardt, W. N., and Walker, C. J.: "Foaming Agents: Cure for Water-Logged Gas Wells," Petroleum Engineer, Nov. 1959, pp. B-28 to B-33.
2. Angel, R. R.: "Volume Requirements for Air and Gas Drilling," **T. P. 4679 Transactions,** v. 210, Society of Petroleum Engineers of AIME 1957, p. 325.

New Benzene Process Found

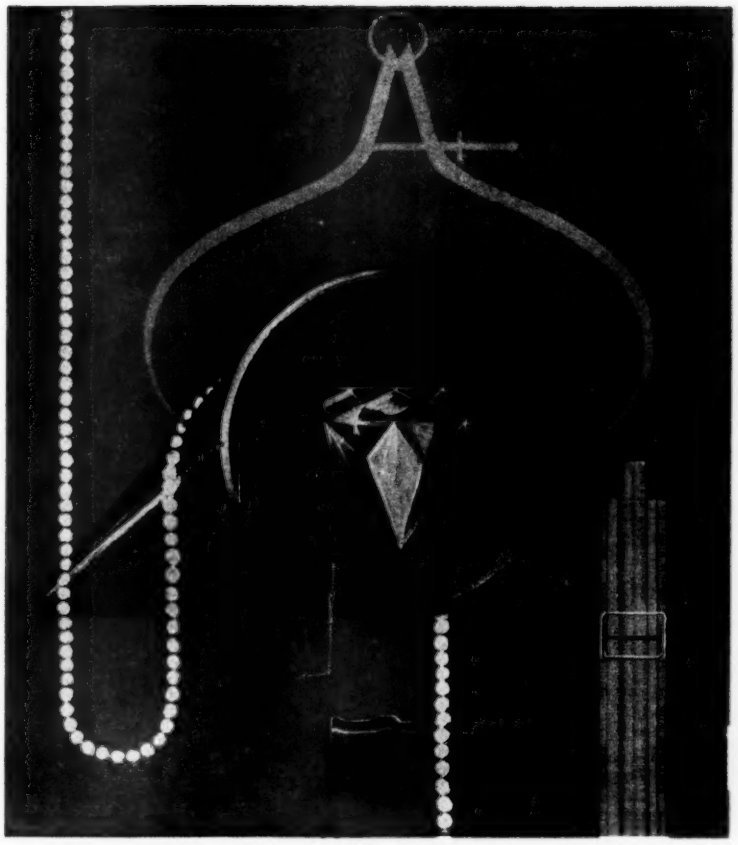
A NEW catalytic dealkylation process—DETOL—will be used by Crown Central Petroleum Corp. in a Houston plant designed to produce 17 million gallons of benzene per year.

DETOL, developed by Houdry Process Corp., produces close to theoretical yields of benzene when dealkylating alkyl benzenes like toluene and xylenes.

The process can be used for dealkylating toluene, xylenes, mixtures of the two, or alkyl benzene concentrates which contain paraffins, olefins, and sulfur compounds.

It converts nonaromatics and organic sulfur compounds, such as thiophene, to light hydrocarbons and hydrogen sulfide.

The makers say the process is easy to control and fairly inexpensive.



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BY W. L. NELSON, Technical Editor and Petroleum Consultant

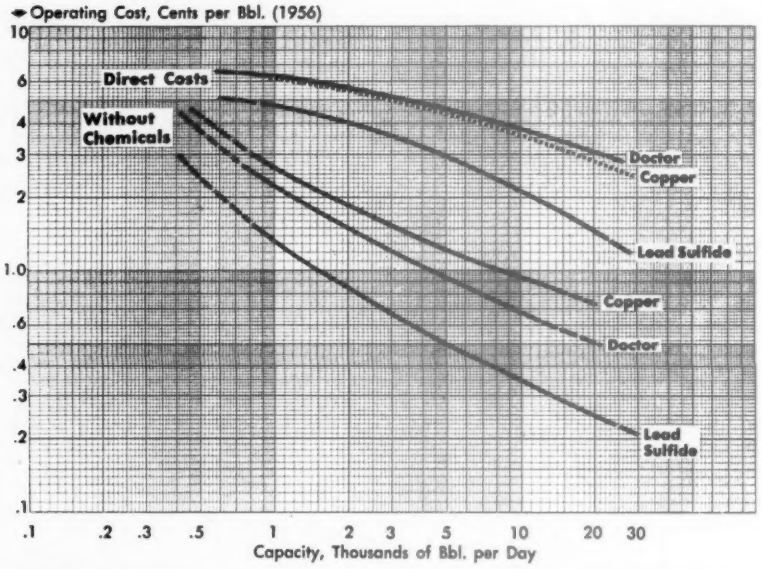
Light-oil treating-4

Oxidizing sweetening processes

ALTHOUGH the sweetening processes which are based on the oxidation of mercaptans to disulfides are often criticized because they fail to remove sulfur, they are still the most widely used sweetening processes. The popularity of the oxidizing processes is based primarily on their simplicity.

Another important factor is the fact that the removal of mercaptans is never entirely complete with the processes which dissolve mercaptans, and thus many naphthas and distillates which have been treated by the solution processes must be finished into "doctor sweet" materials by the oxidation-type processes.

The mercaptan dissolving processes are more expensive than the oxidizing processes but they produce motor fuels which have a superior susceptibility to TEL because of a lower percentage of sulfur. With certain high-sulfur naphthas, notably those produced by cracking, the increase in TEL susceptibility sometimes makes the dissolving processes highly profitable.



APPROXIMATE COST of sweetening processes which oxidize mercaptans to disulfides, in cents per barrel. Obsolescence, depreciation, taxes, insurance, interest, etc., are not included in the cost, but an average precaustic wash for hydrogen sulfide is included. Fig. 1.

TABLE 2—PRICES AND PRICE INDEXES OF CHEMICALS

	Caustic soda	Copper chloride tech.	Earth bags	Litharge	Rock salt
1956 price*	4	40	5	24	1.3
1947	63	..	..	..	48
1950	76	..	..	..	100
1952	81	..	..	..	77
1954	91	89	100	87	97
1956	100	100	100	100	100
1957	104	92	100	93	104
1958	113	89	100	71	108
1959	116	124	100	87	108

*Cents per pound.

TABLE 1—OPERATING COST OF DOCTOR, LEAD SULFIDE, OR COPPER SWEETENING PROCESSES INCLUDING PRECAUSTIC WASH,* CENTS PER BARREL (1956)

		Lead sulfide			Doctor		Copper (slurry)		
	1956 unit cost	20,000 B/D	5,000 B/D	1,000 B/D	10,000 B/D	1,000 B/D	10,000 B/D	1,000 B/D	Refer to Proc. Cost. No.
Operating labor	$3.12/hr.†	0.06	0.18	0.56	0.30	1.12	0.30	1.12	26, 28, 41, 87
Supervision	$3.85/hr.†	0.03	0.09	0.46	0.06	0.55	0.07	0.69	26, 28, 41, 87
Maintenance	Proc. Cost. No. 85	0.06	0.10	0.12	0.12	0.25	0.17	0.43	29, 85, 87
Electric power	0.85 ct./kw.-hr.	0.04	0.04	0.04	0.10	0.10	0.10	0.10	87
Steam	45-60 ct./M. lb.	....	....	....	....	....	0.15	0.15	17, 18, 87
Subtotal		0.19	0.41	1.18	0.58	2.02	0.79	2.49	
Misc. expenses and supplies	(10-20%)	0.06	0.09	0.11	0.10	0.19	0.14	0.23	
Direct cost excluding chemicals		0.25	0.50	1.29	0.68	2.21	0.93	2.72	
Chemicals‡	Proc. Cost. No. 83	‡0.04	‡0.04	‡0.04	(0.15-1.2‡)		(0.12-0.4‡)		83, 85, 87
Precaustic wash	Proc. Cost. No. 49	0.3-3	0.7-4	1-6	0.6-3	1-6	0.6-3	1-6	49
Total direct cost§		1.8	2.94	4.83	3.13	6.36	2.93	6.42	
Treating losses (continuous processing		....	....	....	0.40	0.40	0.40	0.40	
Obsolescence, taxes, ins., etc.	10% per year	0.39	0.64	0.79	0.47	1.00	0.50	1.23	1
Lab. testing	$3.12/hr.†	0.04	0.25	0.75	0.15	0.75	0.15	0.75	

*For caustic washing, see Process Costimating No. 49, June 1, 1959, p. 180. †Averave U. S. refinery wages including 27% for all burdens. ‡Does not include precaustic washing, see next line in table. §Using average costs for chemicals and average precaustic wash.

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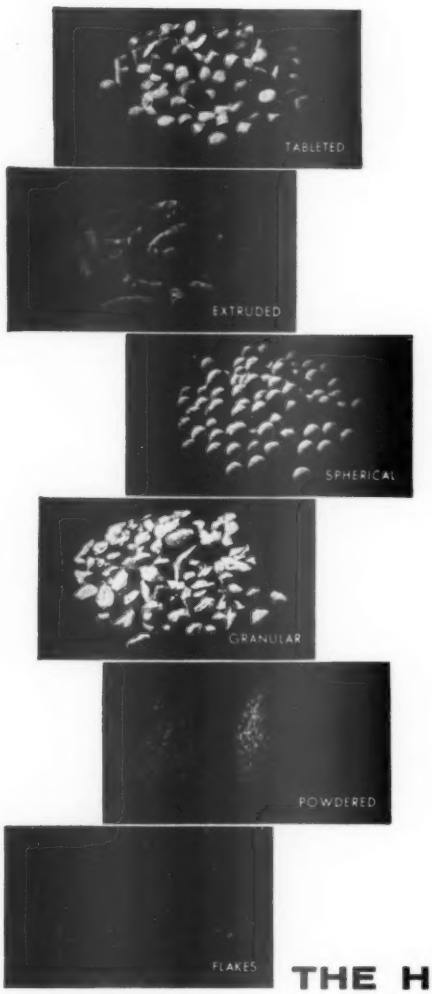

• DEHYDROGENATION CATALYSTS

CHROME-ALUMINA—available in powder or tablet form containing various percentages of chromium oxide supported on high surface area alumina—can be supplied as promoted catalyst and is also available as screened granules.

IRON—tableted iron oxide.

• REFORMING CATALYSTS

MOLYBDENA-ALUMINA—supported molybdenum oxide on alumina—available as microspheres for fluid techniques, or as tablets for fixed bed application.

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MOLYBDENUM SULFIDE—powdered and tableted molybdenum sulfide.

• CHLORINATION CATALYST

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COPPER-CHROMIUM OXIDE—shipped as powder or tablets, stabilized or non-stabilized, with varying ratios of copper oxide to chromium oxide.

NICKEL-ALUMINUM—powdered 50:50 alloy used for preparation of active nickel catalyst for low temperature hydrogenation.

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COBALT THORIA—available as powder or tablets, a thoria promoted cobalt catalyst employed in Fischer-Tropsch synthesis.

COBALT—a supported cobalt catalyst in pellet form used in the synthesis of hydrogen sulfide.

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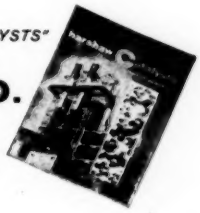

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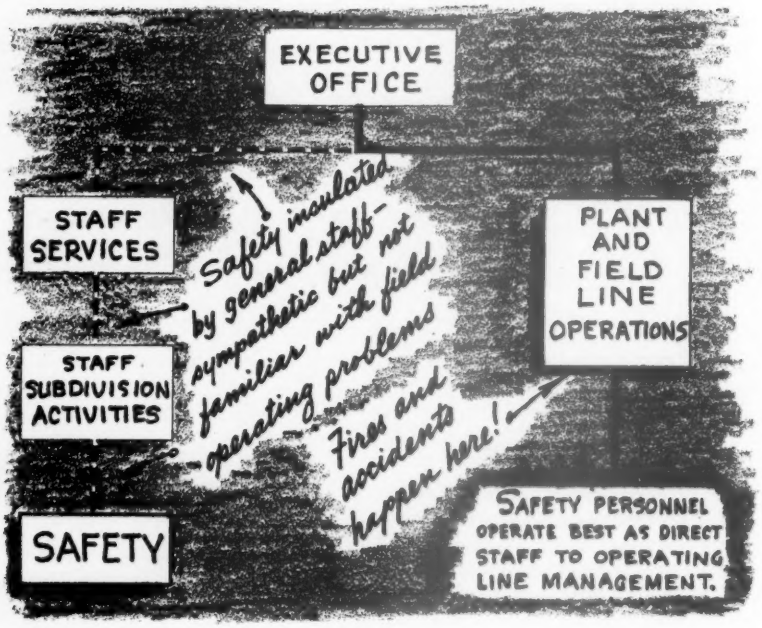
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Establish safety as an independent function

- **Have the safety department report directly to manager or assistant manager.**
- **Make the safety post a key training spot for outstanding men.**

These two moves will vastly improve the company's injury and fire experience.

BY JAMES H. HERBERT
Consultant, Accident and Fire Prevention
Greenwich, Conn.

IT'S BEEN SAID that inasmuch as the responsibility for safety rests 100% with line management, it doesn't matter much where the safety director, coordinator, or engineer is situated in the organization since he acts only as an advisor to the line, and has no authority or responsibility except to make good suggestions for line management's consideration and possible adoption.

It's also been said that because no one person can understand, in detail, every job duty and every operating function, the safety man does not have any line experience. These people think he should limit himself to broad principles and to determining only if line supervision at all levels has established sound safety techniques and then enforce them.

These statements sound good but do not stand up to the test of practicality. For example, how can a safety man know whether an operation is being handled safely unless he has some idea as to what the operator is trying to do? He can't simply ask a supervisor, "Is that operation safe?" or "Are all of your people following safe work practices?"

In the first place, any work effort can always be performed more safely. The **safest** way will probably **never** be found. In the second place, foremen **are glad to have practical** suggestions as to safer ways in which the work effort of their people can be performed. It has been remarked that if foremen get too many of their safety ideas from safety men, they will then leave the job of safety to the safety men. That is not so. I have never run into a supervisor who is not interested in the safety of his people. No supervisor likes to see his men injured, or have the property for which he is responsible damaged or destroyed by explosion or fire. He is constantly looking for new ideas and expects to get many of them from his plant or area safety men.

Safety men are in an exceptional position to learn of new approaches to safer methods. They become aware of them from supervisors in their own companies as well as from safety people in other companies. I don't know of any group of people who are more enthusiastically received throughout any company's operations than the safety people. The reason is that they usually have some new slants on a safer way to do this or that, or some new precaution to prevent a fire or some new method of extinguishing one.

Most foremen have neither the time nor opportunity to travel around even through other departments of their own plant or through other plants of their own company, let alone the plants of other companies. I have heard of many training programs which declare that they should, but I have yet to find any foremen who do it on any regu-

Parts 1 and 2 of this series appeared February 6 and February 13.

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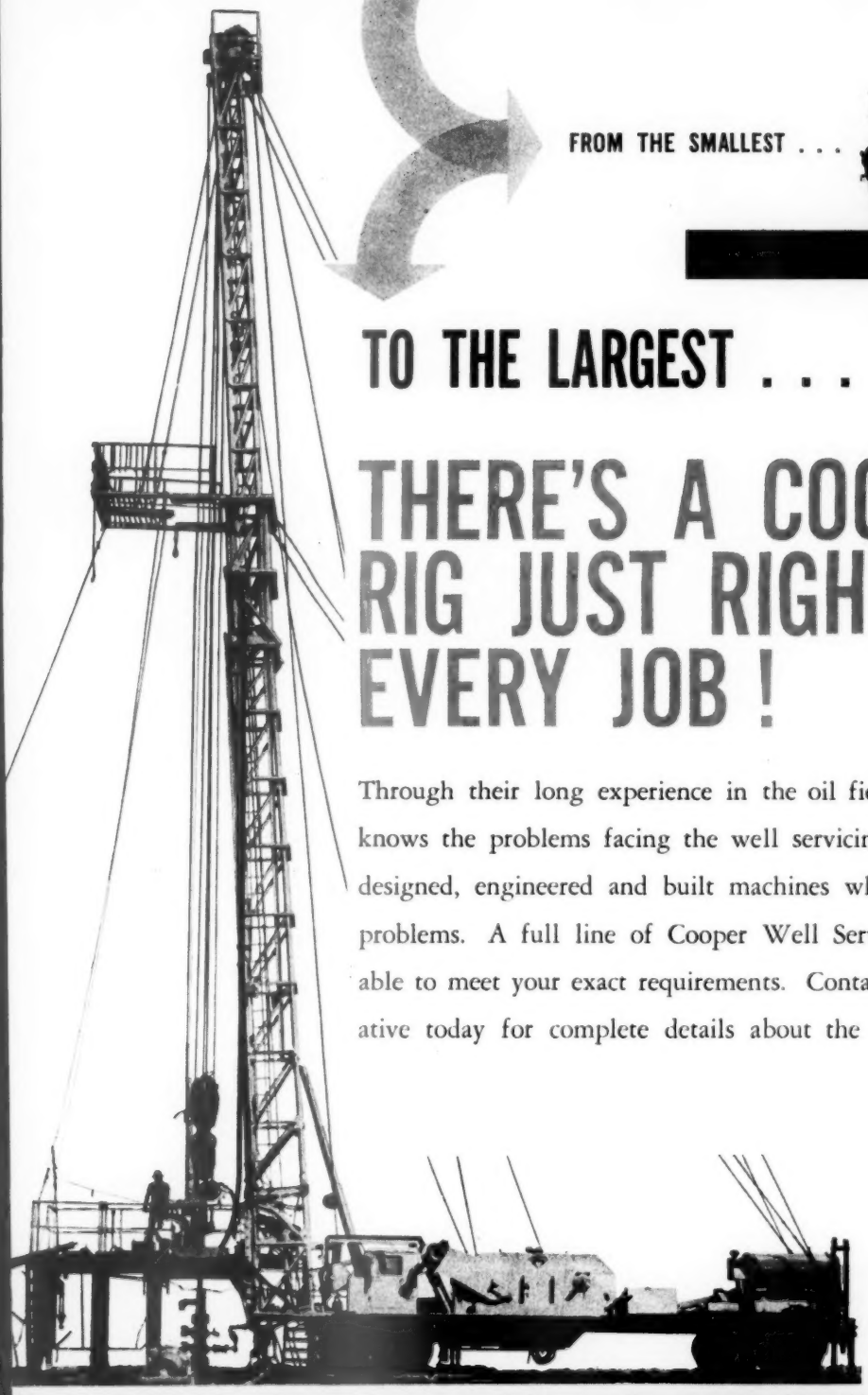

SINCE 1918 — THERE MUST BE A REASON

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lar basis. The safety men are in excellent positions to seek out new safety techniques and ideas and to keep alert for new safety approaches. They should, and many do carry out this function from the design stage to the operating and maintenance stages.

These are the things which most good safety people do regardless of how theoretical they may be expected to be. Actually, the men who have been placed in safety jobs have invariably been practical men from operating or maintenance positions or engineers who have evidenced interest in accident and fire-protection work.

Good training spot. In many cases, managements have overlooked the wonderful opportunity to make the safety position one of the best training spots in a plant, field, or entire company. Where, for instance, can a man who is a comer in a company get a better look at an entire plant, area, field, division, or, for that matter, an entire company, and to improve his knowledge of operations and to meet people in every type of work? There isn't any other job which so completely cuts across all activities except those of a company president or general manager.

There isn't any place where the safety man should not go nor any operation about which he should not ask detailed questions. The safety man is always welcome, because usually he has had line operating, maintenance, or engineering experience. He talks the language of the field line men who are charged with the safety responsibility. With good line background, the safety man can learn details of field operation which he could rarely otherwise acquire. The training possibilities of the safety man have not been generally recognized, and I foresee the day when the safety position will be one of the most popular key training jobs in the petroleum industry.

Most disheartening is a situation where a good safety man has to report to a staff man who has never held a line supervisory job and who has no conception of the safety responsibilities except the broad principle that the safety man should only advise line management. There is never any question about the good intentions of the staff man. He simply cannot appreciate the fine help which the safety people can give to line management at all levels.

Line connection. Not many people will argue against safety being a staff responsibility. Its effectiveness is lessened, however, if the safety man does not report directly to line management, especially at the top level. A good safety man seldom has to call on his boss to be "backed up", but when he does, he needs strong backing.

When staff heads who direct a safety man have not had good line supervisory experience, they cannot grasp the problems. They are reluctant to make an issue of a problem because of their lack of knowledge of everyday working procedures. If they do make an issue of one, their opinion is discounted because of their lack of knowledge. This is hard on a safety man, especially in an emergency, and safety men face many emergencies.

Safety has little stature when it reports to staff people who have not had field line supervisory experience. If a safety man does a good job, his job does not need stature, but how can he do a good job and develop stature unless the field believes that the company attaches good stature to the safety job? People can't help but relate the importance of a job to the position it holds on the organization chart.

If the safety job is tucked under staff activities which are not part of the direct line organization, all of the supervisors as well as the hourly-rate men have a pretty good idea of the value attached to it by top management. In some operations the safety man reports to a staff head only on an "administrative" basis, and he can go to the plant manager any time he pleases. But no one likes to go around his boss, regardless of how little the boss knows about the subject. Such conditions soon become untenable, and the plant's accident and fire records suffer.

In many operations, safety reports to the employe-relations activity which, of course, is a staff function. I have served in many employe-relations activities and so am well familiar with the growing importance of that endeavor. However, I believe employe relations is fast growing to be one of the worst places for safety to report. This is especially true where the employe-relations manager has never had any line supervisory experience, and that is rapidly becoming the case because of the specialized knowledge which that job is now calling for.

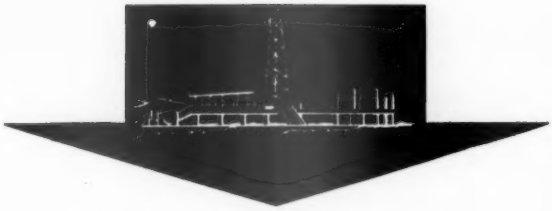
The natural functions of the employe-relations activity are employment, training, personnel testing, performance reviews, savings, insurance, sickness and retirement plans, wage and salary evaluation, and collective bargaining. Safety concerns itself with the safety of property as well as people.

Consequently, safety is not a "natural" for employe relations. Sometime, ask an employe-relations manager how much time he devotes to safety in comparison with the time he devotes to the other items listed. That will pretty well give the answer. Training might be an associated activity but most training people today are experts in the techniques of training, not in the subject matter itself. They are rarely familiar with any of the actual operating conditions where the accident or fire problems exist.

Where the safety man in a plant or field is under the employe relations activity, it can be quickly observed that there is little, if anything in common between him and the employe-relations people. They do not understand the details of his job and he has no natural association with their activities. They are more or less like fish out of water with each other. From any normal business standpoint, they do not think or talk on the same wave length.

Furthermore, a great amount of time of employe-relations people today is taken up with collective-bargaining matters. It is wrong, in my estimation, to associate safety with collective bargaining which, in turn, means controversy and contention.

I firmly believe that those plants or field operations, which are not already doing so, which establish safety as an independent function, reporting directly to the manager or assistant manager, and then make it a key training post for outstanding men, will vastly improve their injury and fire experience.



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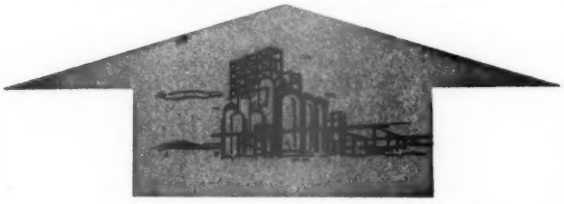

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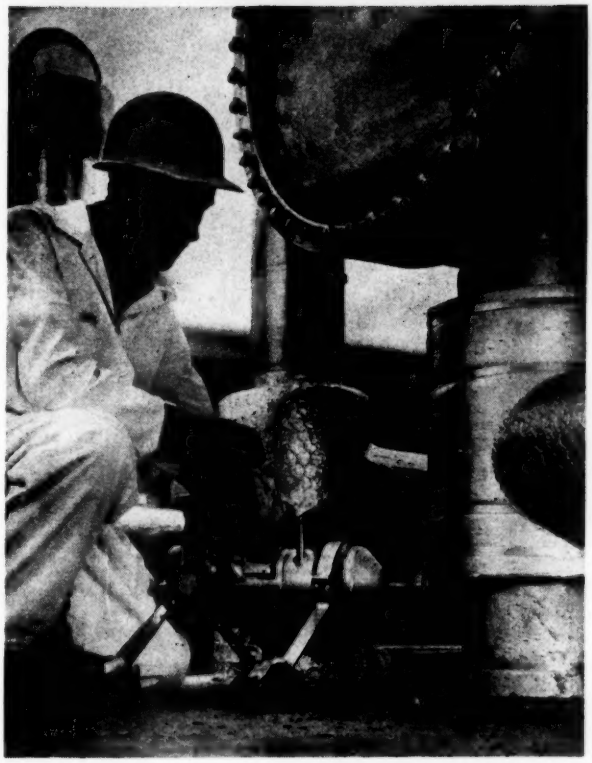

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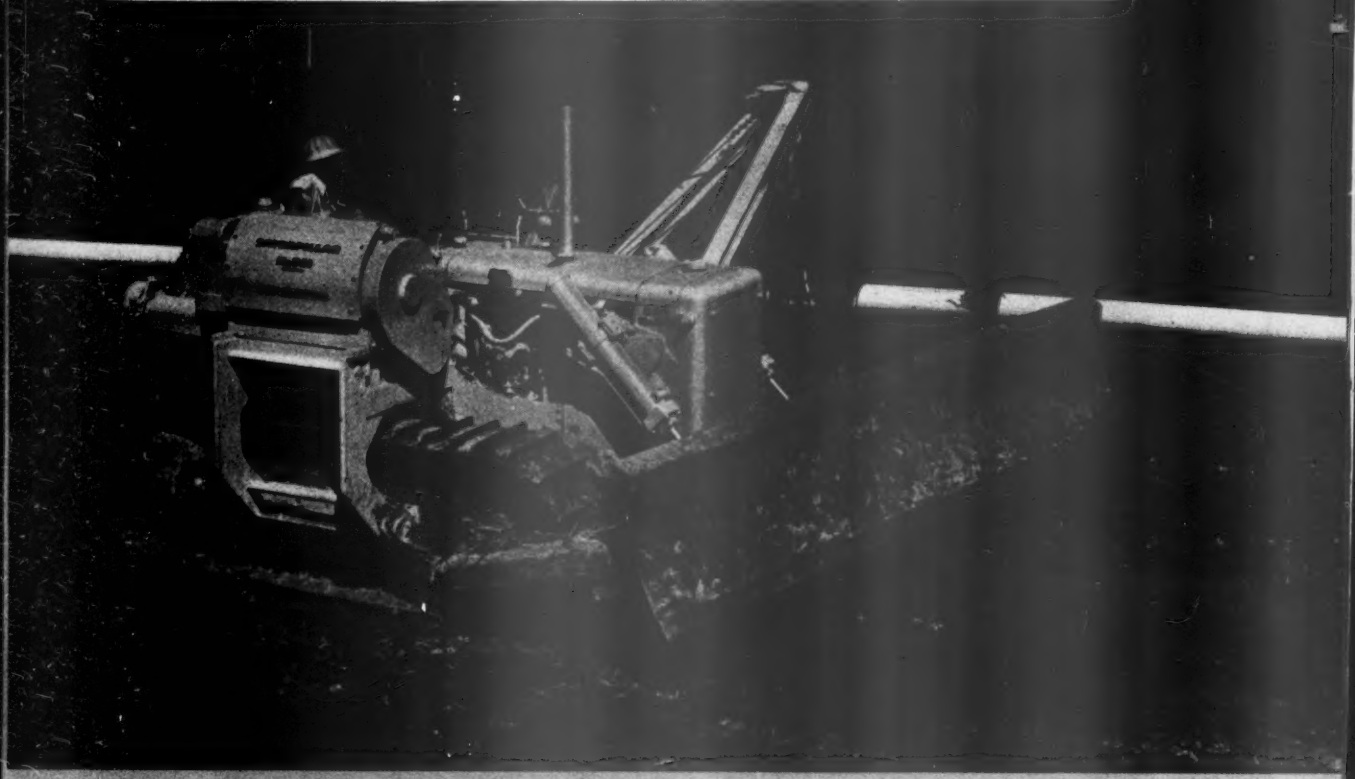

Cat 561 Series B shown here without counterweights at work in Texas handling 10" pipe. For lifts up to 38,800 lb., three counterweight arrangements (fixed and hydraulically adjustable) are available. D333 Engine delivers 93 flywheel HP with high torque at low speed. Has Cat Oil Clutch, lifetime lubricated rollers.

MD7 AND 561 PIPELAYERS ...Caterpillar makes 'em

TAKE THE CAT 561 PIPELAYER—G. W. Townsend Lease Service (Bay City, Texas) used a 561 to lay four miles of 10" and 12" natural gas line for Pan American Petroleum Corp. near Sweeny, Texas. In open country, 600' of pipe was lowered into a 48" by 24" ditch in two hours. In close quarters, an average of 2000' of pipe was lowered in daily.

What do the Townsend people think of the 561? They like the way it handles. They like its balance and the way it responds—fast and accurately. The operator singled out the placement of controls. They're in easy reach, without stretching. Their location permitted him to keep his eyes on the work as he moved along the ditch.

With an angle filler up front, Townsend's 561 takes on extra jobs—backfilling and other utility work. (Another contractor put a No. 6A blade on his 561, uses it for right-of-way clearing. The 561's integral hydraulic system—optional—makes it easy to handle a blade, keeps pump and valves under the hood out of the way.)

All in all, the 561 does the kind of job you expect of Cat Pipelayers. *Dependable*—work done quickly and economically.

OR TAKE THE MD7—Ford, Bacon & Davis Construction Corp., Monroe, La., had about 30 miles of 12" pipe to lay south of Welsh, La., for

Cat MD7 is shown cradling pipe in Louisiana marshland. The Series D MD7 has greater power (140 flywheel HP and 54,200 lb. lifting capacity), improved torque rise (boosts lugging ability by 80%), and there's a new dry-type air cleaner, new, stronger final drives, and many other advantages to boost production and lower costs.

to make money for you

the Louisiana Pipeline Company. The route met an average of three irrigation canals per mile, in addition to Louisiana bayous and swamps. Even so, with three new Cat MD7 Pipelayers in the spread, 4000′ to 5000′ were laid every day.

The MD7's seven-roller track-frame and 22″ track shoes give the new Cat Pipelayer exceptional stability and flotation needed in swamps and bayous. No wonder, then, that Ford, Bacon & Davis are pleased with the performance of the new MD7s. They bought them for high production under tough conditions. And that's what they're getting.

These new Cat Pipelayers have what it takes to turn in performance records even better than previous models. Extra production slashes operating and maintenance costs . . . see your Caterpillar Dealer for the whole story on the new pipelayers. Ask for an on-the-job demonstration.

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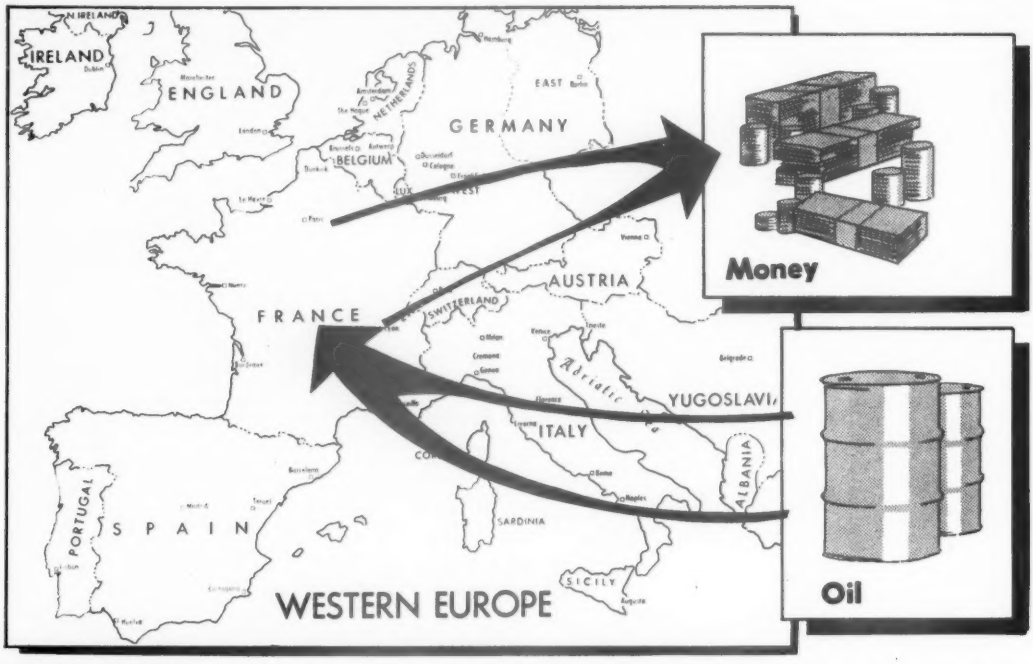


MOST OF EUROPE'S OIL has to be imported and can only be paid for by foreign exchange earned, in the long run, by exports. This drain, coupled with the desire to avoid excessive reliance on imports, led governments to encourage national development.

Oil can't relax in its maturity

BY M. E. HUBBARD
Economic Adviser,
British Petroleum Co., Ltd.

. . . instead it must gird for a continuing competitive struggle with other forms of energy. If it competes too aggressively, it will invite protective restriction. One thing is sure, however: the need for energy will continue to grow, though at a slower rate than has prevailed during the postwar years.

ONE-HALF of the future growth in Europe's energy requirements will be met by increased imports of oil. Over the next 15 years or so these can be expected to grow by 10 to 11 million tons each year on the average. Expressed as a percentage, however, the rate of growth will fall well below the 11 to 15% of the postwar years to possibly 4 to 5% per year by the end of this decade.

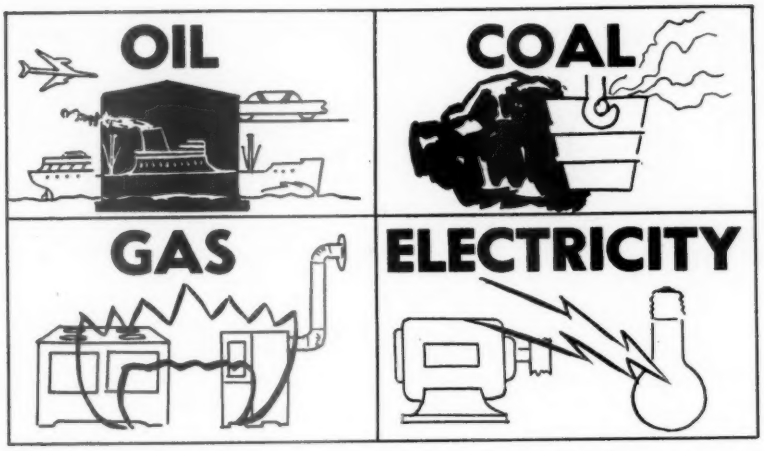
Though oil demand in Asia, Africa, Australia, and South America is growing at a faster rate, increasing production in some of these areas will limit their import requirements. The United States is restricting imports of oil to protect its own production.

The industry faces a difficult period in that, if it tries to compete too strongly with coal, it invites protective restriction, and if its prices are too high it will fail to attract the marginal consumer who can choose the form of energy most economic for his particular purpose.

Oil's competition. Outside the American Continent (where the proportion is somewhat higher) and the Soviet zone (for which information is lacking) total consumption in the automotive field represents only a third of total oil consumption. Two-thirds is used for purposes where oil has no monopoly; other forms of fuel or energy can be used, and oil is in direct competition with coal, electricity, etc.

In some of these "competitive" end uses oil has a technical superiority which assures its use even when considerably more costly. One extreme example of this is at sea where bunker oil has completely ousted coal. At the other end of the scale, oil is not suitable as the main fuel for blast furnaces since

Paper presented at Second Arab Petroleum Congress, Beirut.



FOR MANY END USES oil has advantages over coal, though frequently only of a technical nature; on the other hand it is often a less convenient form of energy than gas or electricity.

metallurgical coke is needed to reduce the iron ore; this end use is in fact "reserved" to coal (though it may not remain so forever).

For a large number of end uses oil has advantages over coal, though frequently only of a marginal technical nature; on the other hand it is often a less convenient form of energy than gas or electricity.

All major oil companies make studies of potential demand at least for the countries in which they trade. In the past, when the greater part of the demand was for "reserved" end uses, it was often sufficient to examine past trends of oil consumption and apply then, possibly some arbitrary adjustment, to the future. But now that the use of oil has expanded so greatly and so much is used in the "competitive" sector, this simple approach no longer suffices.

It is necessary to consider what may be the total energy demand of each country, what other energy resources are available locally, and what are their economic and social significance. Only then is it possible to evaluate the possible increase in demand for oil.

OEEC Study

An energy study has recently been made by the Organization for European Economic Cooperation (OEEC). The report goes deeply into the whole energy position, forecasting how it may develop during the next 15 years.

Western Europe consumes three-quarters of the total energy used outside the American Continent and the Soviet zone, so that the report is of outstanding interest to all connected with Middle East oil. It starts by considering how the total demand for energy is likely to rise.

This problem was approached in two ways, by examining the relationships between energy and gross national product and industrial production and by considering the main sectors of end use and how these are likely to develop. The commission also obtained the views of other bodies, including some of the oil companies as well as the coal and electricity producers, etc.

The commission came to the conclusion that, taking 1955 consumption as 100, the likely future upper and lower estimates of demand, together with the mean or most probable figures for total energy demand are:

TOTAL ENERGY (1955 = 100)

1955	Actual		100
1965	Upper estimate 125 Lower estimate 135	Mean	130
1975	Upper estimate 158 Lower estimate 183	Mean	170

The mean figures correspond to a rate of growth in total energy of 2.65% per year in each of the periods 1955-65 and 1965-75. The actual 1959 consumption of energy was quite close to the figure interpolated from the commission's mean forecast.

In any energy study a distinction has to be made between primary and secondary forms of energy. A consumer may use energy in its original or primary form, e.g., burning oil or coal as such, or he may use electricity or manufactured gas. These are classed as secondary insofar as primary fuels have been used to make them.

The commission started its analysis by dividing the total energy demand into (1) the "more specific" (or reserved) demands either for oil (e.g., road and air transport) or for coal (e.g., carbonization for the production of metallurgical coke) and, (2) the "more flexible" (or competitive) demands which could make use of more than one form of primary energy. This was further divided into the primary fuels needed for conversion into secondary forms of energy and the general demand for primary fuels for use as such.

The forecast is shown in Table 1. To enable the various forms of energy to be compared the commission adopted, as a common yardstick, a ton of (average) hard coal. One ton of oil was taken as equivalent to 1.43 tons of coal, i.e., in the relationship of their calorific values.

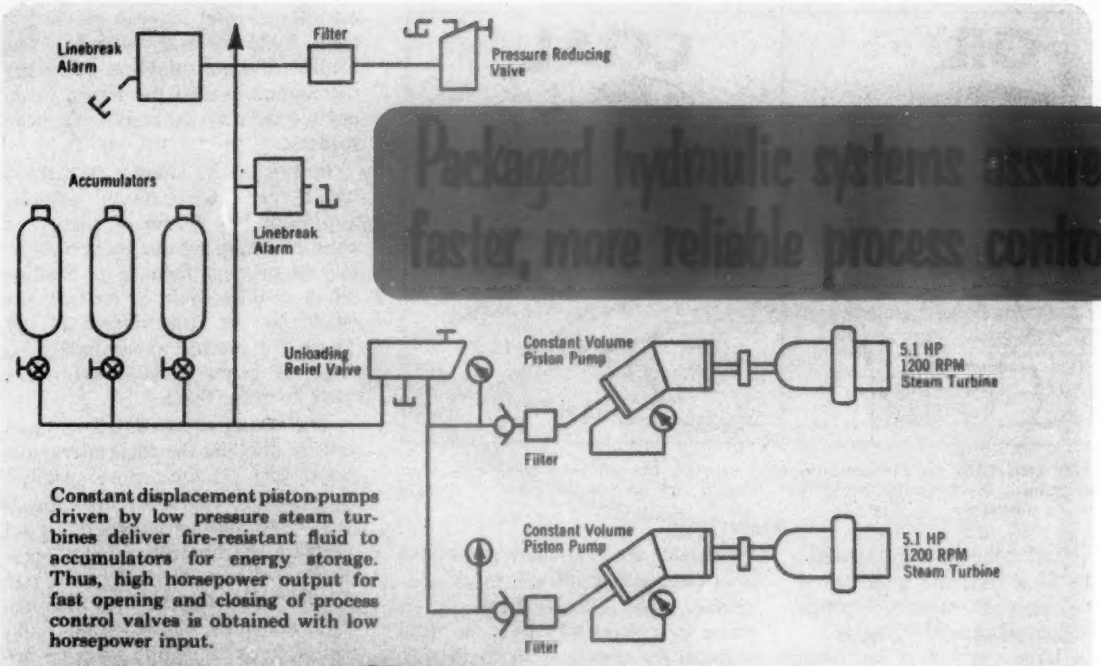
Consideration of end use still leaves a wide field of choice among different forms of primary energy, a choice which depends on availability, price, and other factors.

Coal production in Europe has been nearly constant between 471 and 481 million tons (m.t.)) per year since 1952; this is below the peak of 501 m.t. reached in 1929, and even below the 1913 level. While mechanization of coal production tends to reduce absolute

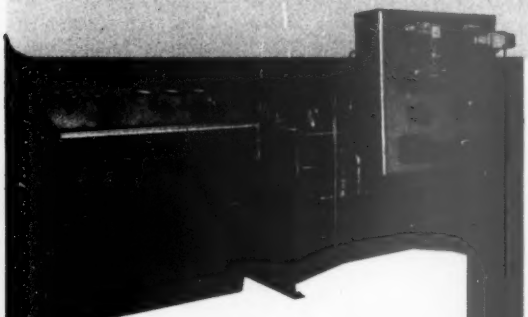
TABLE 1—TOTAL ENERGY DEMAND
(In million tons hard-coal equivalent)

	1955	1965	1975
More specific demands:			
Coal: chiefly for carbonization	170-200	200- 225	200- 250
Oil: chiefly for transport	50- 70	100- 125	150- 175
More flexible demands:			
For electricity generation	185	300- 325	450- 475
Other	322-372	295- 450	325- 625
Total	777	970-1,050	1,225-1,425

Packaged hydraulic systems assure faster, more reliable process control



Constant displacement piston pumps driven by low pressure steam turbines deliver fire-resistant fluid to accumulators for energy storage. Thus, high horsepower output for fast opening and closing of process control valves is obtained with low horsepower input.



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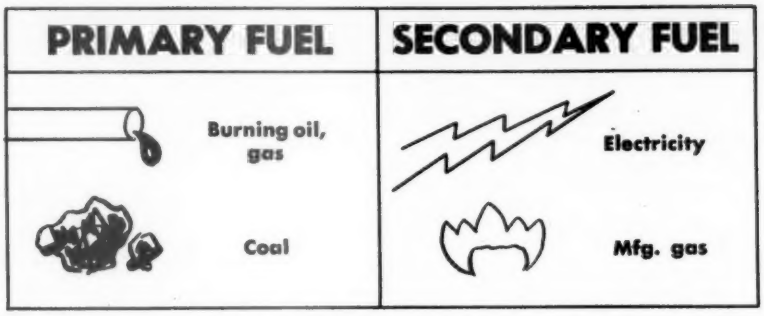


IN AN ENERGY STUDY a distinction has to be made between primary and secondary forms of energy. A consumer may use the energy in its original or primary form, or he may use electricity or manufactured gas. These are classed as secondary since primary fuels have been used to make them.

costs this is offset by the increasing exhaustion of many mines and increased wage rates.

Taking all factors into consideration, including the social consequences of a too rapid reduction in employment in the mining industry, the commission thinks that coal production will stay relatively constant (or very slightly falling) and suggests that in 1965 it is likely to be between 440 and 480 m.t. and in 1975 between 430 and 495. Lignite, used mainly in power stations, has been much cheapened recently by new methods of mining and its production is considered likely to double. But since its hard-coal equivalent in 1975 is only put at 60 m.t., lignite is not of major significance in the over-all energy picture.

It is naturally very difficult to estimate how much oil and natural gas may be discovered and produced in Europe but the commission thinks that each, at most, might contribute about as much energy as lignite, i.e., a maximum of 4 to 5% of Europe's total energy requirements.

Hydropower. This is expanding rapidly and is estimated to increase from 56 m.t. HCE (hard-coal equivalent) in 1955, to 95 m.t. in 1965, and 140 m.t. in 1975, though by then two-thirds of the economically workable hydro potential will have been harnessed.

Considerable attention is given to the prospects of nuclear energy. At present it is not economically competitive with thermal generation, and the commission does not think it can become so before 1970-1975. There is, therefore, a wide margin of uncertainty about its future contribution and between 15 and 20 m.t. HCE is suggested for 1965 and between 30 and 90 m.t. by 1975.

The commission points out that Europe cannot possibly meet all its energy requirements from its own resources, and large-scale imports are a necessity. Much the greater part of these, it considers, will be in the form of oil, but some coal will be needed, mainly special qualities, and natural-gas imports may develop.

The over-all pattern of energy supply is shown in Table 2.

In 1955 oil's contribution to Europe's energy supply was 20½%. These figures show that the commission considers that its share will increase to 30-32% of the total in 1965 and 35-39% in 1975. Table 3 shows this growth.

TABLE 2—ENERGY SUPPLY
(In million tons HCE)

	1955	1965	1975
Total demand	777	970-1,050	1,225-1,425
(mean)		1,010	1,325
Coal—Indigenous	(477)	(440-480)	(430-495)
Imports	(28)	(10-60)	(10-60)
(Total coal)	505	450-540	440-555
Lignite	30	45	60
Hydropower	56	95	140
Nuclear energy		15-20	30-90
Other forms of energy	20	20	20
Natural gas—Indigenous	(7)	(25)	(50-60)
Imported		(5)	(10-75)
(Total natural gas)	7	30	60-135
Oil—Indigenous	(13)	(30)	(50)
Imported	(146)	(260-310)	(380-500)
(Total oil)	159	290-340	430-550

TABLE 3—TOTAL OIL REQUIREMENTS
(Millions of tons)

	1955	1965	1975
Total oil demand	111	203-238	300-385
Mean		220	342
Total oil imports	102	182-217	266-350
Mean		200	308

Oil growth. Taking the mean figures, imports into Europe will grow in the period 1955 to 1965 by an average of 10 m.t. each year, equivalent to 7% per year over the period, and in the period 1965 to 1975 by an average of 11 m.t. each year, equivalent to 4¼% per year over the period.

Use of coal will remain constant or fall very slightly. Lignite usage will grow by 4% per year and then 3% per year in the two periods of 1955-65 and 1965-75 respectively. Hydropower usage will grow by 5½% and 4% per year.

The role that the new forms, natural gas and nuclear energy, may take in the future is much more difficult to forecast as is shown by the wide margins given by the commission. Starting from very small figures their percentage rate of growth will, of course, be high but even on the most optimistic forecast both these new forms of energy together would, by 1975, carry only some 16-17% of the total energy load and their share might well be as low as 7%.

Political Factors

The great bulk of Europe's oil has to be imported and can only be paid for by foreign exchange earned, in the long run, by exports. For a number of years this drain of foreign exchange, coupled with a desire to avoid excessive reliance on imports from distant countries, led governments to encourage the development of indigenous sources of energy.

Though today anxiety on this score is lessened, the impetus given is leading to increased production of hydropower, indigenous oil, and natural gas, and has greatly stimulated nuclear-energy development.

These reduce potential demand for imported oil and insofar as they do not involve foreign exchange and raise no question of security their full use will be encouraged by gov-

ernments even if they are not fully competitive in the strict economic sense.

Legal problems. The coal-mining industry is long established and one of the biggest in Europe. Many of the coal fields are remote from industrial centers. It employs over 1½ million men. Though it is generally admitted that the number of miners must be reduced no government wants this reduction to be so rapid as to cause acute social problems of rehousing and readaptation of labor.

What is considered a reasonable rate of reduction in the number of miners is roughly offset by the increased output per man resulting from mechanization of the mines.

The governments of the coal-producing countries are under heavy pressure from their coal industries to restrict the competition of oil. This shows itself in a number of ways. There is a debate on the subject at most meetings of the European Parliamentary Assembly.

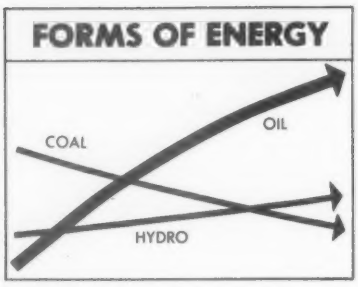
The Inter Executive Committee of the OEEC, the European Coal and Steel Community, and Euratom have circulated an interim report to the OEEC governments suggesting a target price for energy to be used as a guide for investment in coal production, and asking whether the governments consider that fiscal policy in regard to other forms of energy (by implication oil) should be based on this target price.

Germany has already put a tax of DM 25 per ton on fuel oil.

This anxiety about coal is evident in other countries too; in the United Kingdom, for instance, the government has asked the oil companies to accept a reduction in some contracts for supplies to power stations (which are equipped for dual firing) though they are resisting constant pressure from members of the opposition is Parliament to impose a tax on fuel oil.

The oil industry is, therefore, in a dilemma insofar as much of the big European market is concerned. If excessive competition with coal leads to protective restrictions by governments it may lose business; if, on the other hand, prices are not attractive to the marginal consumer, it again will lose business.

Should a sound course be followed, it can be expected that demand for oil will grow faster than the demand for all its competitors together and it would be a greedy industry that asked for more.



OIL DEMAND can be expected to outpace the demand for all its competitors together, provided a sound course is followed.

Other areas. Apart from Europe there are, of course, other important areas outside the Soviet zone and North America requiring imports; much of Asia, much of Africa, all Australasia, and large parts of South America. In all these areas, oil demand is likely to grow at a considerably faster rate than in Europe, but their indigenous sources of oil are also growing rapidly.

It is extremely difficult to gage how fast their imports may grow since there are so many unknown factors involved, but an average rate of 5 to 7% per year would seem a probably maximum and, in any event, their imports will remain small in comparison with Europe's in the foreseeable future.

Similarly it is very difficult to gage what imports will be needed in the future by the North American Continent. Oil demand in the U.S.A. in particular is growing at an average of around 3 to 4% and this rate is unlikely to increase in view of the strong competition of natural gas.

Further, there are government-imposed import restrictions and it is impossible to gage how long these will be maintained. In the long run North America is likely to become a major importing area, but for the time being its requirements are limited.

Industry maturing. These facts in no way spell a reverse for the oil industry; they mean that the industry is reaching maturity and should look at its future through realistic glasses. The period of meteoric rise in demand is over and oil no longer benefits from shortages of other forms of energy, though the industry can still look to a higher rate of growth than that of any of the other major forms of energy with the possible exception of natural gas in areas near its production.

They also mean increased competition both within the industry and with other forms of energy and thus no certainty that any new source of production can immediately be used to capacity or that existing sources can necessarily rely on a continuous increase in output.

COMING IN MARCH...

The Latest on Natural Gas and Gas Liquids

THESE IMPORTANT SUBJECTS will be explored in great detail in two special reports in The Oil and Gas Journal next month.

★ **In the March 13 issue,** the Journal will feature a special report on natural gas and gas pipelines. Here you will find out about new methods used in the gigantic Canada-to-California pipeline, the status of the natural-gas market in California, and a rundown of the gas-reserve picture in Texas.

★ **In the March 20 issue,** the Journal will bring you its annual gas-processing report. Highlight will be a survey showing all plants in the U. S. and Canada, capacities, throughputs, and a breakdown of liquids production. This valuable report will also include an expert analysis of the gas-processing picture as it exists today, as well as significant papers from the annual meeting of the Natural Gasoline Association of America.

Watch for these two timely reports in the March 13 and March 20 issues of the Journal.

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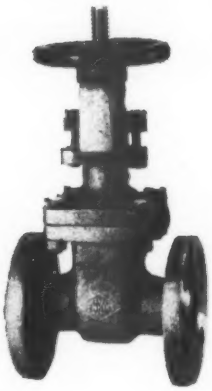

Most of the alloy specs were developed to meet certain highly specialized and rather uncommon needs. Only 1 out of 100 valve users can make practical use of many of the alloys. *Actually, just two or three of the different available alloys will give a big majority of valve users all they want and need.*

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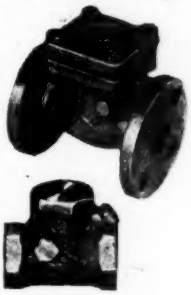

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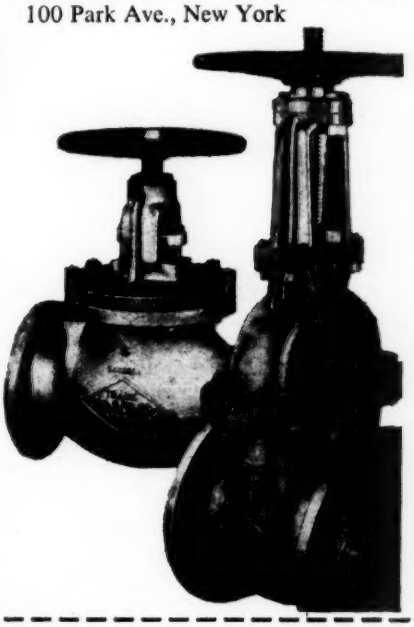

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AUTOMATIC CUSTODY TRANSFER EQUIPMENT at the central facility, Magnolia field, Arkansas. Each meter shed houses two meters in parallel. One can be in service while the other is on the proving cycle, connected to the prover tank on the right. The three systems shown here are identical except for capacity, and each serves a different pipeline company.

Magnolia field goes automatic

OIL PRODUCTION from 4,300 acres in Magnolia field is now under complete automation.

Atlantic Refining Co. as unit operator has recently put its latest lease-automatic-custody-transfer facility "on stream" in the Magnolia-Smackover pool unit, Columbia County, Arkansas.

Some of the important features of the system are:

- Four test centers that meter oil to a central facility.
- Gas measurement by p.d. meters.
- Automatic well testing that can be programed a long time in advance.
- Separate handling facilities for wet oil and clean oil.
- Vapor-recovery system on the surge tank.

As of October 1960, there were 42 producing oil wells, 12 water-injection wells, and 3 water source wells in operation.

System is designed for 17,500 bbl. per day, and production was increased to that amount on January 1, 1961.

BY W. B. BLEAKLEY
Production Editor

System Advantages

Besides the reduction in daily supervision of field operations, the unit has benefited in other ways.

- Crude price has increased 4 cents a barrel on gravity maintenance alone.
- Operating costs have gone down more than 50%.
- Maintenance costs have been reduced sharply.
- Reserves have been increased because of reduced oil shrinkage.
- Vapor-recovery system has cut down gas waste, thereby increasing profits.

Reservoir Conditions

Surface facilities are no more unusual than the subsurface conditions in the Reynolds member of the Smackover lime.

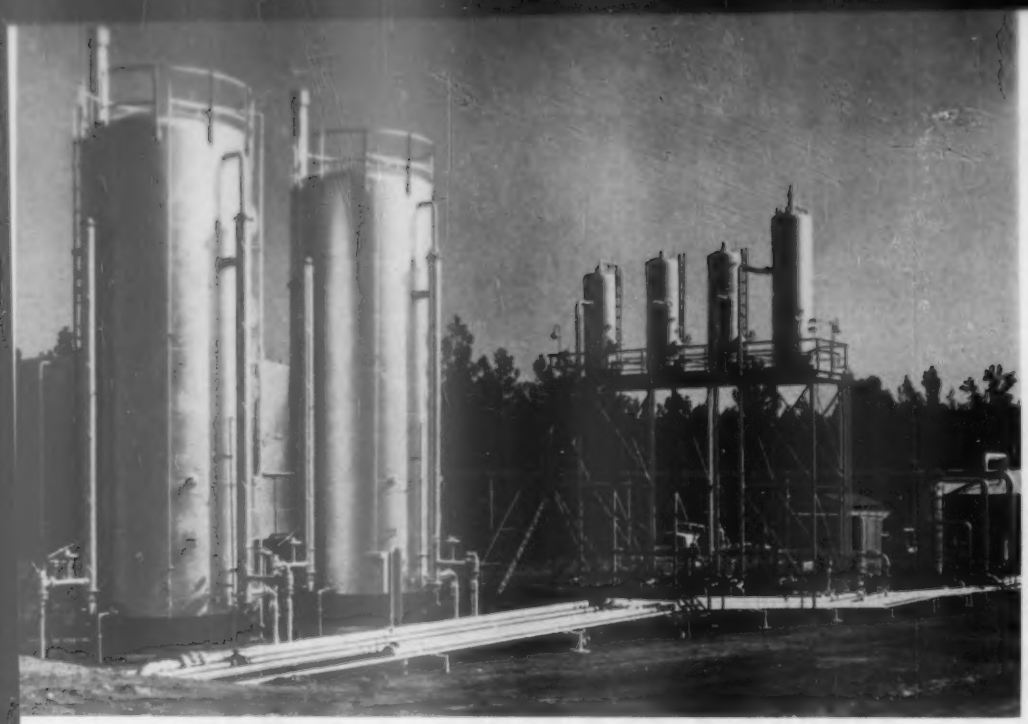
Because of reservoir anomolies, there are a number of different water levels in the productive zone. Over-all plan is to inject water into the various parts of the reservoir at rates proportional to the recoverable reserves remaining in those parts. Result will be a leveling out of the water table, displacing oil up into the region of more uniform permeability.

Four Test Centers

The 42 oil wells in the unit produce assigned rates ranging from 100 to 2,000 bbl. per day to four test centers located at various points in the field. Locations for the test centers were chosen on the basis of convenience and topography. Each test center was designed to take care of the production from the nearby wells on the basis of oil volumes, water cut, and gas-oil-ratio.

Each of the test centers is the heart of one of four parallel oil-handling systems.

At the test center are located three separators, one for wet oil, one for clean oil, and one for well testing. Reason for this arrangement is economics. Output of the clean-oil separator goes directly to the central facility, and isn't handled by the treater at the test center. Thus



OIL FROM the test centers comes into the central treating area through these four separators on the elevated platform. On the left are the central treaters, and behind them is the 20,000-bbl. surge tank. Also at the central facility is the custody - transfer equipment, shown in another photo.

• Four satellite test centers feed production to a central metering facility in this southern Arkansas oil field. System features new ideas in metering and handling of sour crude with emphasis on safety and reduced maintenance.

a smaller treater is needed than if all oil were to be processed.

The wells feeding each test station are manifolded so that they can be produced into any of the separators or treaters through normal valves. Also included in the manifold are automatic valves that are tied in with the well-test programer, to switch a preselected well from normal production to test.

The manifold is wired through a control panel in such a way that a high level in any of the satellite vessels will shut in all wells producing to that vessel. For example, if the level in the wet-oil separator trips the high-level float switch, all wells producing to that separator will be shut in at the manifold.

These high-level switches play a key role in the operation of the satellite stations. Trouble at the central facility, to be covered later, merely closes the valves leading from the satellite stations, and there is a backup of oil into the test-station vessels. This in turn shuts in the wells, as explained above.

When the high-level condition is relieved, all valves return to normal positions, and the wells go back on stream automatically.

Gas is handled several different ways at the test centers.

High-pressure gas from the separators goes through a trunk line to the central facility and then on to gas sales.

Gas from the treater is handled differently at different test centers. (1) It may go through a low-pressure trunk line to the suction side of a gas compressor, or (2) it may be commingled with oil in the oil trunk line for separation at the central facility.

When a well is on test, the gas from the test separator is metered through a high-pressure, diaphragm-type p.d. meter. Gas from the test treater is also measured by a p.d. meter, but of a low-pressure type.

Some test stations, because of well capacities, use two p.d. meters in parallel behind the test separator.

Water from the treater goes into a gathering system for subsequent injection.

Testing. When a well is on test, production is routed through the test separator, and then to the test treater, whether the oil is wet or clean.

Oil is metered at the output side of the test treater by a volume-type dump meter. Test-treater gas goes into the low-pressure trunk line to the central facility.

Why p.d. meters?' Diaphragm-type p.d. gas meters were chosen because of the range of rates to be encountered. Wells producing at various rates are automatically put on test according to a predetermined schedule. The well being tested one day may make a lot of gas, and the one being tested next day may make very little gas. Under these conditions, an orifice meter would not be too suitable, as the orifice plate may have to be changed daily, defeating the purpose of the automatic system.

All p.d. meters in the gas system are equipped with correcting devices to reduce the measured volumes at field temperature and pressure to standard cubic feet.

Well tests set pattern. Except for well testing, oil production is not metered at the test centers. Production from the entire center is prorated back to each well according to its test figures.

While the well-test schedule is programed in advance, it can be manually overriden at any time.

When a well is on test, impulses

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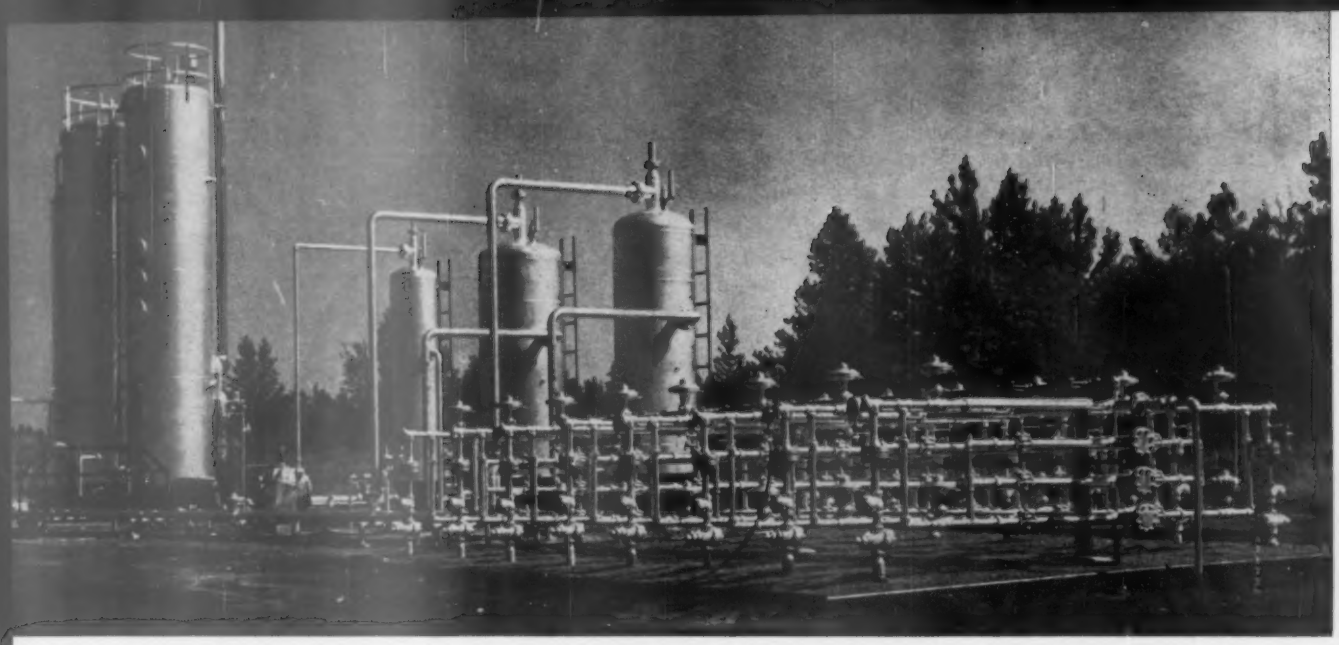


ONE OF FOUR TEST CENTERS that Atlantic has installed in Magnolia field. Shown here are three separators, one for clean oil, one for wet oil, and one for well testing. Wet oil goes through one of the treaters at the left, and the other is used for testing. The complex manifold is used to route individual wells through any of the vessels as needed. Most of the valves are manually operated except those that control the test cycle.

from the test meters are recorded on a trip chart for oil, water, and gas. Also on the chart is a coding mark to identify the well.

When the automatic valve switching puts a well on test, the strip chart is disconnected from the system for about 15 minutes. This allows the system time to purge itself of oil from one well before the production from the next is metered. Then the strip chart goes back in the circuit and data is recorded.

Normal tests are carried on for a 24-hour period.

Complex manifold at each test center is set up so that any well can be routed to any of the separating vessels at the center. But all valves are manually controlled except those that are used in the automatic well-test feature of the system, and there the choice is made only between normal production and test.

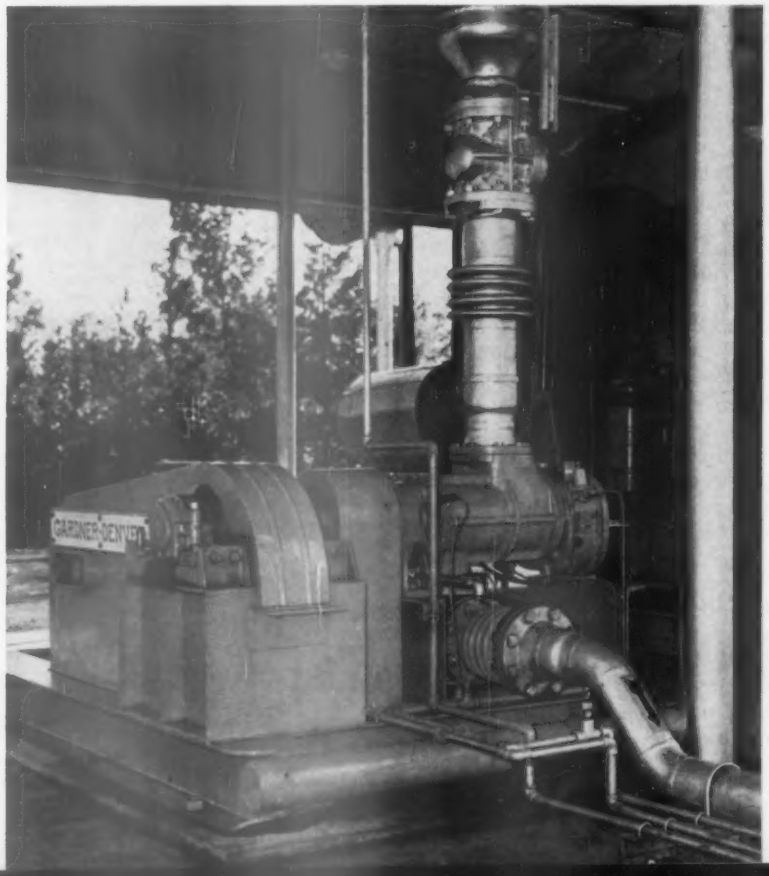
Central Facility

The four test centers deliver their oil to the low-pressure separators at the central facility. In the cases where test-center treater gas is commingled with the oil, the incoming stream to the central-facility separators will include this gas also.

The central separators, one for each test center, are mounted on an elevated platform, and are operated at a pressure of 15 psi. Low-pressure gas from these separators goes to the suction side of the compressor installation.

Oil from the bottom of the separators flows, by low-pressure differential and gravity, through the dump line and a b.s. and w. monitor. Bad oil is directed to the central treating setup, and clean oil goes directly to the 20,000-bbl. surge tank.

This central b.s. and w. monitor is the only point where the operator



MOTOR - DRIVEN rotary compressor is used to increase the pressure of the stock - tank vapors. These vapors are then commingled with the low-pressure gas from the central facility and compressed to 100 psi. for delivery to pipeline.

gets an indication of trouble at the test center. Test-center treaters are not equipped with monitors, but bad oil at the central facility in any one of the four incoming lines will turn on signal lights and shut down the output of the offending test center until the trouble is located and corrected.

Treating setup at the central location is there just to take care of any small amounts of bad oil that might get through the test center, or oil that is rejected by the ACT equipment. Capacity is there to handle total production, if necessary.

The b.s. and w. monitors have a built-in time delay so that a slug of water will not trip the warning system or the routing valves.

Automatic-Custody-Transfer Equipment

There are actually three ACT units serving the field—one for each pipeline company taking oil. They are identical except for capacity.

From the surge tank the oil flows through two centrifugal charge pumps in parallel. Purpose of these pumps is to insure a positive head to the meters and to the suction side of the pipeline pumps. Normally only one of these pumps would be needed. To insure uniform operating conditions, the pressure through the meter loop is kept fairly constant.

Oil then passes through a monitor that limits the b.s. and w. to 0.5%. If clean, the oil flows through a deaerator, a strainer, and then into the temperature-compensated p.d. meter. The meter setup includes an automatic sampling device which kicks out a small quantity of oil on pulses from the meter. But samples are still cranked out by hand to get b.s. and w. content and API gravity.

Each system has two meters in parallel, so that one can be in service and the other can be simultaneously on the proving cycle. Right after installation, each meter was on a weekly proving schedule. Then after 6 months, proving will be done every 2 weeks.

A complex manifold system ties all meters into the 25-bbl. prover tank.

Controls on the ACT equipment include daily and monthly allowable limits, but volumes are picked up daily from the meters' ticket printers when b.s. and w. and API gravity are checked.

Vapor Recovery System

Pressure on the surge tank is maintained between 2 and 4 oz. per sq. in., and the vapor space is connected to the suction side of a Gardner-Denver rotary compressor. This is believed to be the first vapor-recovery installation using a compressor of this type.

A two-speed electric motor is used to drive the compressor. Automatic controls for the motor are operated by pressure in the suction line, so the motor can operate at low speed, high speed, or "off" to keep up with the supply of stock-tank vapor. Output of the rotary compressor is commingled with low-pressure gas and goes to the suction side of the sales-gas compressor.

Gas Sales

High-pressure separators at the test centers are maintained at 125 psi. so that the gas can be sent directly into the sales line. Required delivery pressure is 100 psi.

Low-pressure gas and the recovered vapors from the surge tank are handled by a gas-engine-driven compressor to reach the 100 psi. point.

Delivery is made to Arkansas-Louisiana Gas Co., which operates a gasoline plant to take care of the rich ends in the gas stream.

Automatic Features

Besides the usual automatic devices normally found on ACT systems, such as bad oil being rerouted on signal from the b.s. and w. monitor, the Atlantic system at Magnolia field has some different features.

The surge tank has safety stops for low levels, high levels, pressure relief, etc. Crude from the field is sour, and as a safety precaution, a sweet-gas blanket is kept on the crude in the tank. Pressure-relief vent is located a good distance from the tank as the vapors are toxic. Relief valve is set at 4-oz. pressure.

Every vessel in the system is equipped with a high-level float switch. If the fluid level in any separator, treater, or other vessel rises to a preset point, all wells behind the vessel are shut in till the trouble is located and corrected.

BOOKS

FUEL CELLS, POWER FOR THE FUTURE, by David R. Adams, Pierre-Yeves Cathou, Robert E. Gaynor, Robert D. Jackson, Jr., John H. Kirsch, Lawrence L. Leonard, George S. Lockwood, Jr., W. Paul Warnock, and Russell E. Wilcox, Jr. Published by Fuel-Cell-Research Associates, P. O. Box 157, Cambridge 38, Mass. 160 pp. $18.75.

This volume was originally written as a partial fulfillment of the requirements for the degree of Master in Business Administration at the Harvard Business School.

One objective of the study was to determine the commercial and engineering practicality of present and potential fuel cells. This has been done by establishing a method of evaluating fuel-cell performance, analyzing existing fuel-cell developments, and comparing present and future fuel cells with conventional sources of power in various power applications.

A second objective was to investigate the status of fuel-cell technology and present the technical operations and limitations of fuel cells, and to investigate the various chemical fuels used in fuel cells.

CANADIAN OIL & GAS DIRECTORY, 1960-61. Published by C. O. Nickle Publications, Ltd., 100 Petroleum Bldg., Calgary, B. C. 400 pp. $4.

This book is divided into 12 sections, dealing with oil and gas producers, explorers and developers, service and supply companies, engineers, designers, constructors and fabricators, geophysical and exploration drilling contractors, financial and investment, lease brokers, natural gas, power distributors and pipeline companies, oil-well servicing, petroleum refiners, marketers, natural-gas processors, and a personnel index.

The personnel-index feature is an alphabetical listing of key persons within the industry. About 7,000 top men with their company, position, and telephone number are included. Another portion of this book which has proven helpful is a separate section of government departments, associations, and clubs within the industry. The book lists over 2,000 firms primarily engaged in the oil and gas industry of Canada.

POLYESTER RESINS. By John R. Lawrence. Published by Reinhold Publishing Corp., 430 Park Avenue, New York City 22. 251 pp. $5.75.

This book presents a review of polyester resins from the standpoint of chemistry, curing, and diversified applications. It is aimed at giving a better understanding of the materials and how they are used, without becoming unduly involved in theoretical considerations. The book is intended to supply architects, designers, users, salesmen, and possibly executives with background information on the subject.

The chapter on coating applications is the most complete coverage ever published on this relatively new use for polyester resins. The appendix includes a tabulation of the basic characteristics of the standard resins manufactured by the jamor resin suppliers together with related reference material. Numerous tabulations, figures and illustrations contribute to the book's usefulness to readers in fields both directly and indirectly associated with the use of polyester resins.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

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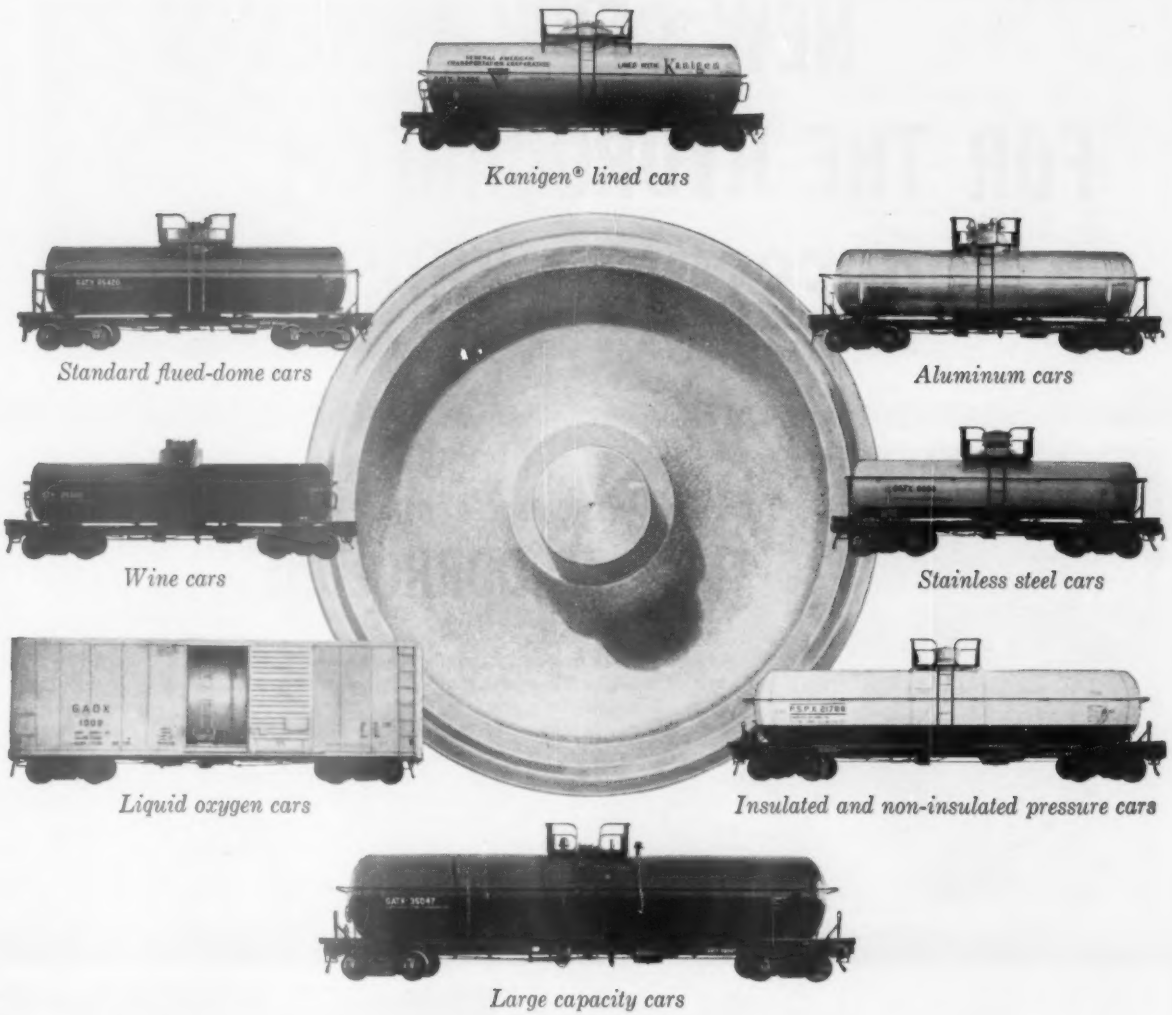

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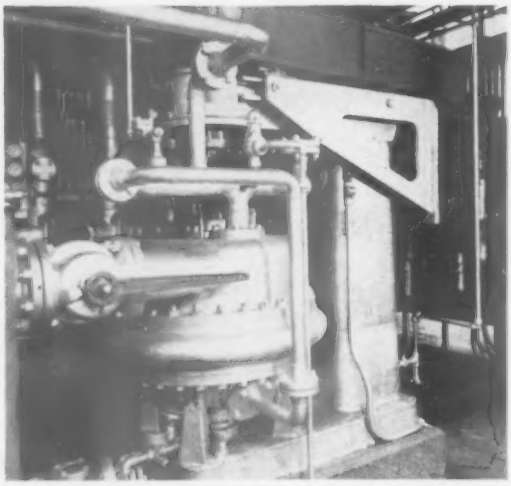

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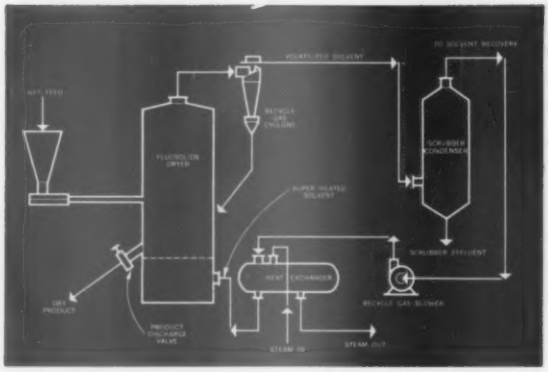

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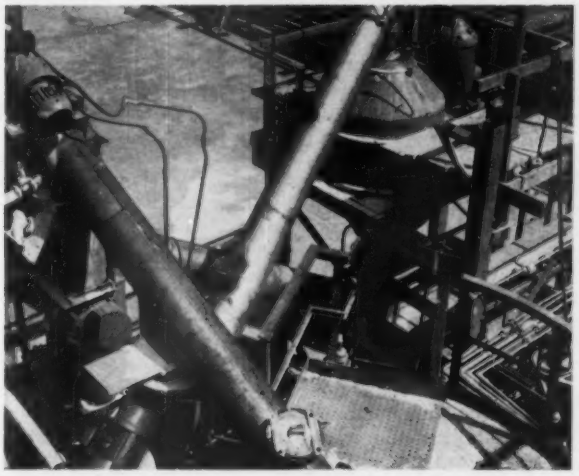

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Things to watch in combustion

YOU SHOULD KNOW the normal firing rate of a particular furnace. Then, when something goes wrong, you can determine whether excessive firing is the cause. Firing rate can be determined by multiplying the gas or oil flow rates by their respective heating values (B.t.u. per cubic foot or B.t.u. per pound).

Draft can be read from the draft gage located on the furnace.

Stack temperatures are available on most furnaces. This information can be obtained from a temperature indicator usually located in the unit control house. Stack temperatures appreciably above normal should be investigated. They may represent afterburning.

Coil temperatures are normally a measure of the furnace heat requirement. High coil-outlet temperatures can lead to coking. Low coil-inlet temperatures may mean that preheat equipment should be cleaned.

Feed stocks to the same furnace may have widely different boiling ranges. Therefore the heat requirements for these different stocks may vary widely, even though the coil inlet and outlet temperatures remain the same.

Watch the flow rate through separate passes in similar sections of the furnace. They will provide a good indication of how well the heat is being distributed. If these rates vary widely, one side of the furnace will be overfired and the other side underfired. This is undesirable and some remedial action should be taken, particularly if the unit is at peak throughput. In practically all cases, if this imbalance is observed and cannot be corrected, the coil-outlet temperature should be held constant by varying the oil rate.

Safety Precautions

A torch must never be inserted into a furnace until the firebox has been thoroughly ventilated with steam. Proper purging consists of injecting steam into the firebox at the proper rate, and continuing for at least 30 minutes after steam has started to come out the stack.

Steam should be cut in through the normal firebox connections and also through the burners if steam-atomizing burners are provided.

Steaming out the firebox is necessary both before lighting a cold furnace and before relighting a firebox in which the burners have gone out. Before steaming it is essential to check to see if all fuel-oil and fuel-gas connections to the firebox are correctly shut off.

Burner torch. Always use a standard asbestos wick torch for lighting a furnace. Fuel should be heavy fuel oil containing some kerosine or heating oil. Never use a light volatile material. The torch should be lighted with care and snuffed out in a safe manner. Never try to douse the torch by stepping on it.

Lighting burners. When lighting a burner do not stand directly in front or underneath the burner. Stand as far to one side as practical. This will prevent burns in the event of a flame flashback. And always remember to wear goggles and gloves.

- The burner should never be lit off an adjoining burner or off a hot wall of the firebox.
- If burners are operating or the firebox is hot, be sure that either steam or oil is flowing through the tubes before lighting the furnace.
- Be sure that both steam hoses and portable fire extinguishers are readily available.
- Frequently, one man cannot start the furnace by himself. The distances may be too great to insert the torch and then open the gas valve. Get help. Don't try to do it all by yourself.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Division of Humble Oil & Refining Co.

Quiz on combustion

1. The most economical firing conditions in refinery furnaces are usually obtained when you have
   .... (a) a small amount of excess air (15%)
   .... (b) a large amount of excess air (40%)
   .... (c) no excess air

2. One change that can be made to increase the amount of secondary air to a furnace is to
   .... (a) decrease furnace draft
   .... (b) open air ports in burners
   .... (c) open stack damper

3. One possible cause for too high a stack temperature is
   .... (a) fuel-air mixture is too rich
   .... (b) too much excess air
   .... (c) too little excess air

4. If the flame from an oil burner is too long, one way to shorten the flame is
   .... (a) increase steam
   .... (b) decrease primary air
   .... (c) shut damper

5. One indication of uneven heat distribution in a furnace is
   .... (a) high stack temperature
   .... (b) high tube-metal temperature
   .... (c) high coil-outlet temperature

6. Stack smoke from a furnace is excessive. One possible cause is
   .... (a) too much excess air
   .... (b) fuel rate increased without air adjustment
   .... (c) fuel-air mixture is too lean

7. Burner flame alternately ignites and goes out. You should
   .... (a) open secondary air doors
   .... (b) close secondary air doors
   .... (c) reduce firing rate immediately

8. Torch fuel should be
   .... (a) kerosine containing some heavy fuel oil
   .... (b) heavy fuel oil containing some kerosine
   .... (c) naphtha

9. The minimum time to steam out a fire box before start-up is
   .... (a) 5 minutes
   .... (b) 15 minutes
   .... (c) 30 minutes

10. A high pressure drop across furnace tubes is normally an indication of
    .... (a) tubes coking
    .... (b) too high a firing rate
    .... (c) flame impingement on tubes

COMBUSTION QUIZ ANSWERS

1. (a) A small amount of excess air.
2. (c) Open stack damper.
3. (b) Too much excess air.
4. (a) Increase steam.
5. (b) High tube-metal temperature.
6. (b) Fuel rate increased without air adjustment.
7. (c) Reduce firing rate immediately.
8. (b) Heavy fuel oil containing some kerosine.
9. (c) 30 minutes.
10. (a) Tubes coking.

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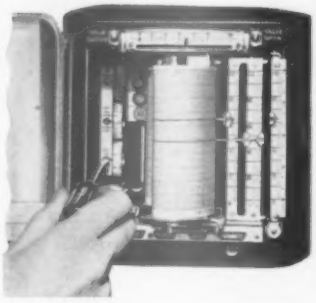

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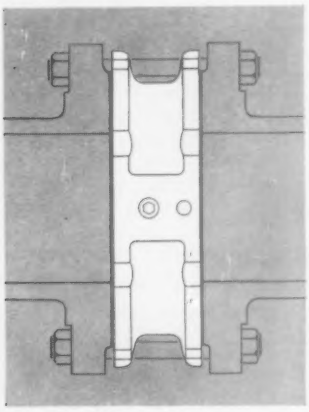
MEAN ACCURACY FIRST

The Duo-Chek® is easily lowered into position between the flange faces; because of its light weight, special handling equipment is unnecessary. Fits standard valve flanges. In sizes 2 inch through 12 inch, one valve fits series 125, series 150 and series 300 flanges, saving inventory at less cost than a conventional 150 series. The machined outside diameter centers the Duo-Chek between series 300 flanges; the slots center it for series 150 flanges.



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Duo-Chek valves come in a complete range of end connections and sizes from 2 to 48 inches, for ASA pressure ratings of series 125 through 2500, and for temperatures to 1400°F. They are made in steel, stainless steel, aluminum, and bronze. Sealing materials are Buna-N, Teflon, Viton, or metal depending on your service.

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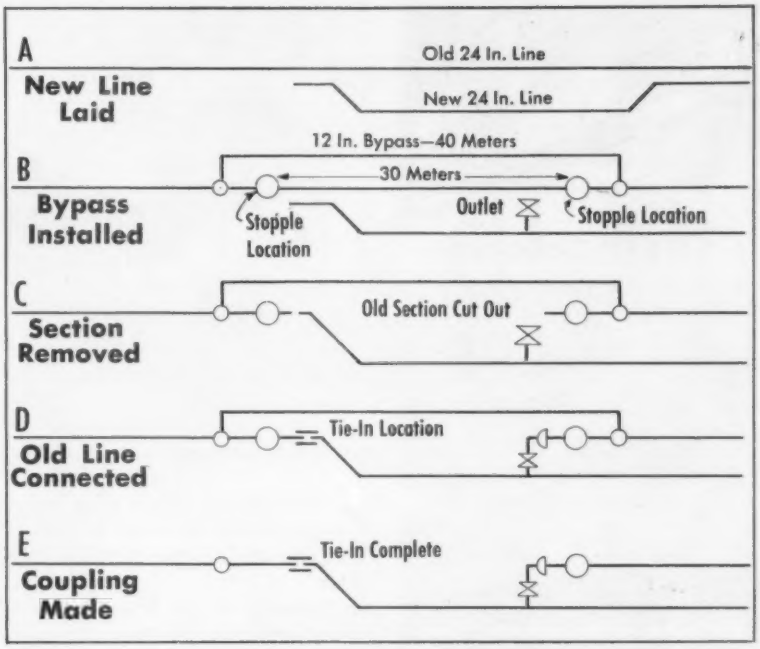
On the Job

PIPELINING

These 5 steps show how to repair operating pipeline

BY JOHN P. O'DONNELL
Assistant Pipeline Editor



HOW CONTINUOUS FLOW WAS MAINTAINED while faulty section of Sahara crude-oil line was replaced with parallel line is shown above.

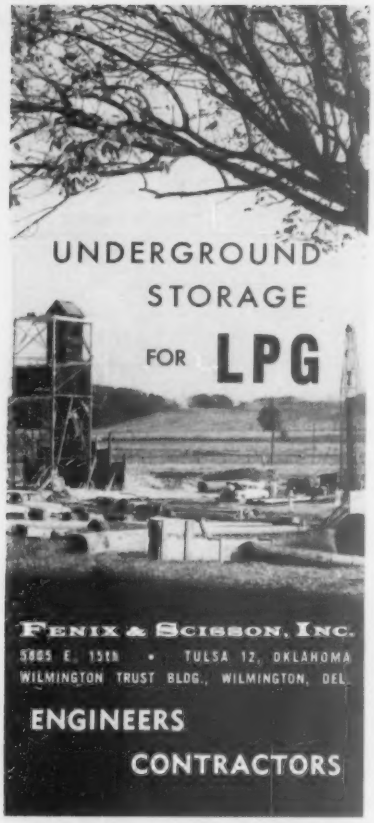
REPLACING a section of an operating 24-in. crude-oil pipeline can be a routine matter. But, when it is undertaken on an isolated location in the Sahara with sandstorms and inexperienced help, it can pose some very real problems.

The SOPEG line from Algeria's Hassi Messaoud field to the Mediterranean port of Bougie has been in operation since late 1959. During its first year of operation, a num-

STOPPLES AND BYPASS in place before section of leaking line is cut out. Fig. 1.

SLIP-ON COUPLING connects new and old lines as oil goes through bypass. Fig. 2.

SECOND STOPPLE INSTALLED to relieve balky unit damaged by pressure, sand. Fig. 3.



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EXCESSIVE PRESSURE bent stopple which did not leak despite damage. Fig. 4.

ber of leaks developed. They were concentrated in a 20-km. section of the pipe which had a poorly welded seam.

Presence of the leaks was disclosed while the line was still operating at less than maximum. It had been planned to increase the capacity by raising the pressure. This would certainly have resulted in more leaks and, probably, in a shutdown.

Since production at the field was limited to the capacity of the line and since there was a demand for more crude oil at the terminal, a shutdown could not be tolerated. It was decided then to replace the defective section while keeping the line in operation.

System devised. The method used was a system of Stopple Plugging machines and bypasses. It worked and proved two things: A four-stopple job can be done with three stopples; a technical adviser with the ability to improvise is essential.

First step was to lay a new line parallel to the bad section of the old line. It was curved at either end to align with the existing line. Enough ditch was left open to allow movement of the new line and the rest backfilled.

Bypasses at the two points where the old line was to be cut were almost identical. A 20-m. section was marked for removal at each point. Full-branch split tees were welded to the line for stopple locations. They were about 30 m. apart, one on either side of the section to be removed. About 5 m. further out, half-size branch split tees were put in for bypass connections.

Tapping valves were installed and the taps completed. A 1200 tapping machine was used for the large taps and a 660 machine for the small ones.

COUPON welded to plug extension installed in flange to let valves be removed. Fig. 5.

Flanges tested. The nipple and valve at each tap were filled and a pressure gage was installed on the tapping machine vent. The boring bar and cutter were advanced into the liquid until the pressure exceeded that in the pipeline to test the welding and flange connections before making the tap. Special care was taken to make sure that all air was purged from the fittings.

It was during this stage of the work that the most severe sand storms were experienced. They made work extremely difficult and finding one's way about almost impossible. Tools and equipment

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dropped on the ground were soon covered and lost. Goggles were a necessity and sand got into the most minute openings. Engine-air cleaners and similar equipment were cleaned and serviced daily. Despite these conditions the hydraulic power units and the tapping machines worked most satisfactorily.

When the stopples were installed and the bypass bolted in place, the job site appeared as in Fig. 1. An outlet and valve were installed near the ends of the new line to connect with the old line before it was isolated.

Bypass tied in. The upstream outlet was temporarily connected to the bypass piping. A pig, equipped with noisemaker and radioactive material, was put into the new line. A stop was fabricated and installed at the other end to stop the pig. Both ends were capped and the filling begun.

Progress of the oil could be easily traced since the noisemaker was clearly heard through the covering of 1 to 2 m. of sand. The radioactive material could be detected only where the pipe was uncovered. It proved such a hazard that its use was considered inadvisable.

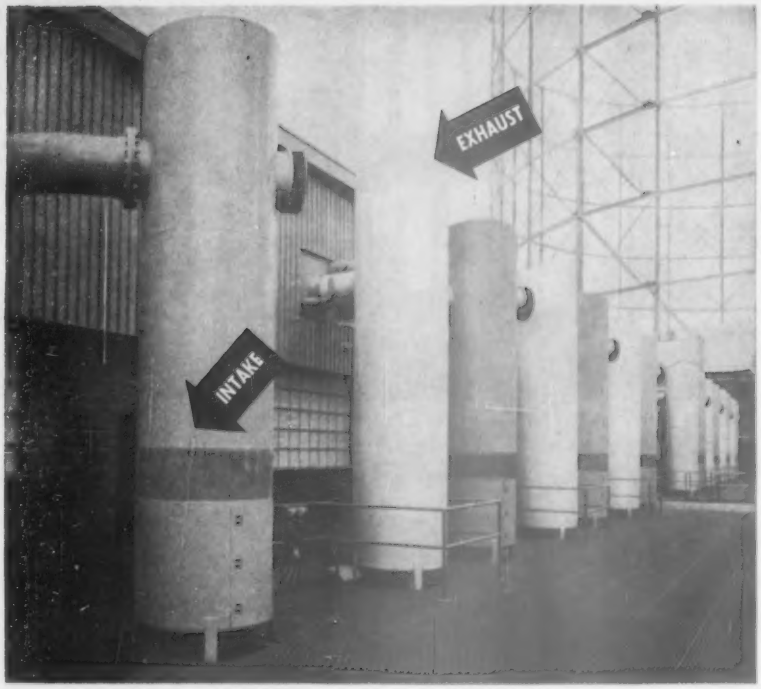
The new section was then pressure-tested with an engine-driven, positive - displacement p u m p. No leaks were found.

Bypass valves were opened and the stopples on the upstream end lowered. The marked section was removed. The line was then operating around the gap.

Stopple use cut. A cap was welded to the butt end of the old line, the pressure equalized, and the stopple at this location removed. This cap had an outlet to connect to the outlet valve on the new line when it was in its final location. Transfer of this stopple to the downstream end made it possible to do a normal four-stopple job with three.

This operation was repeated on the downstream end and, when it was completed, the line was operating around both gaps.

A slip-on type of coupling was installed over the end of the old line (Fig. 2) and the caps removed. The pig retained the oil at the downstream, downhill end and only a small amount of oil ran out the upstream, uphill end. The new line



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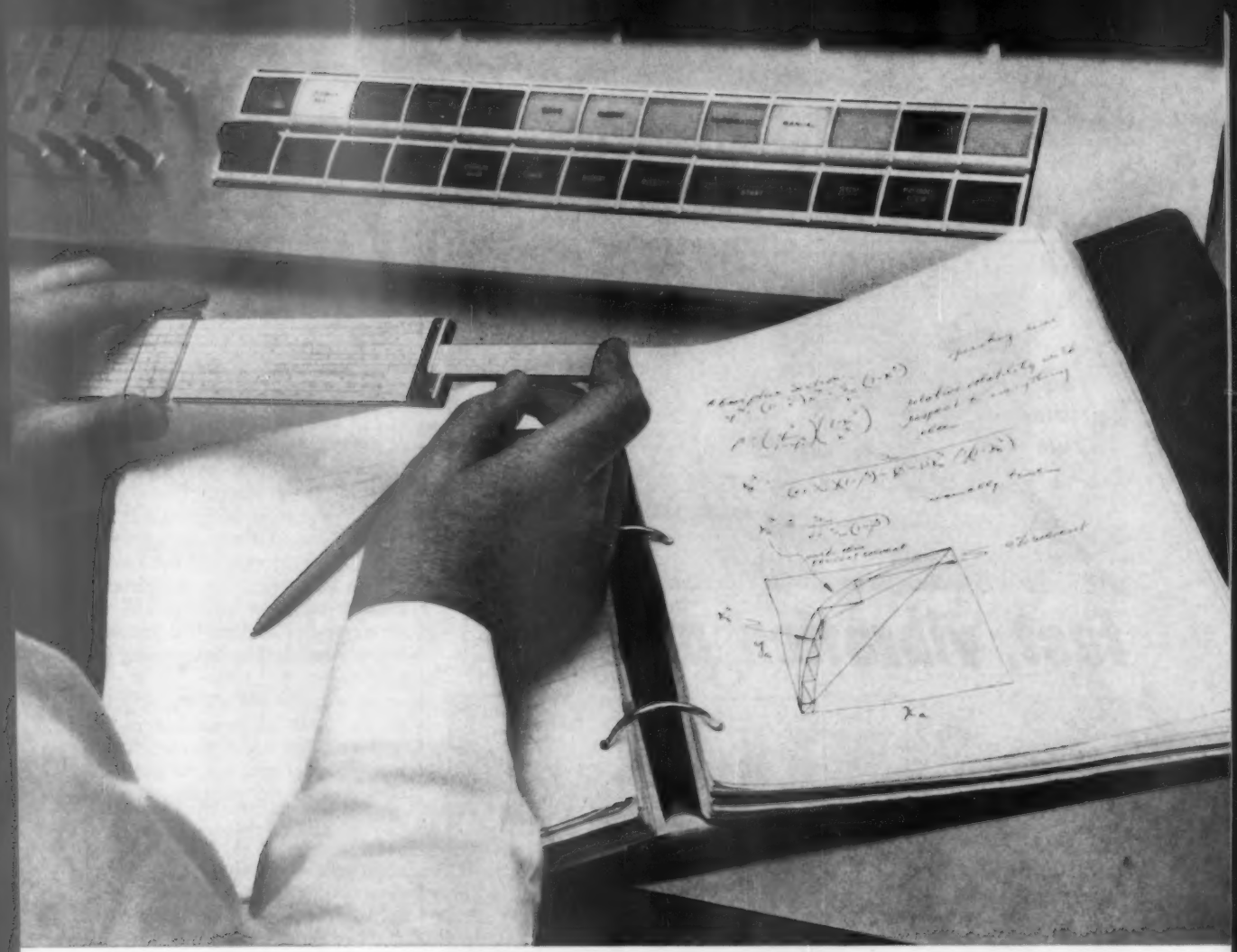

Solve vapor-liquid equilibrium problems quickly, easily with the new low-cost IBM 1620

You can now perform unit operations calculations in minutes with IBM's new Unit Operations Simulator for the 1620. The Simulator consists of 13 automatically available sub-routines*. These are short programs stored in the machine which can be called on to solve your vapor-liquid equilibrium problems.

Included also is an interpreter which allows you to link together the sub-routines you want to use for the problem you are working on at the moment. The *language* of the interpreter is symbolic. This makes it easy to use and eliminates the need to write a detailed program in machine language.

The Unit Operations Simulator is available free of charge to all users of IBM 1620 Data Processing Systems. A basic 1620 rents for just $1,600 a month. Ask your local IBM representative to give you complete details on this versatile, low-cost engineering computer.

IBM's 1620 is a compact desk-size computer.

*Here's what the Unit Operations Simulator does for you: **1.** Computation of equilibrium constant. **2.** Computation of temperature from a given equilibrium constant. **3.** Computation of enthalpy of a vapor and/or liquid stream. **4.** Find equilibrium constant nearest unit. **5.** Computation of temperature from a given enthalpy of a vapor and/or liquid stream. **6.** Bubble point and dew point calculations. **7.** Split one stream into two at specified ratio. **8.** Mix two streams of same phase. **9.** A mixed feed adiabatic flash calculation. **10.** Adiabatic flash. **11.** Isothermal flash. **12.** Flash to a specified quantity of vapor. **13.** Absorber/stripper calculation using Edmister short cut.

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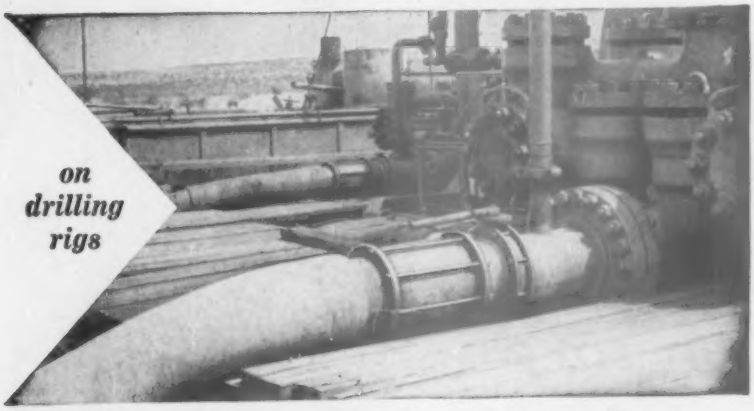

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was moved into alignment, the coupling slipped over joint and tightened against the pipe and packing.

Coupling blowout. Because of the curve in the line, the technical adviser recommended that the couplings be welded before pressuring. It was not done at first on the theory that the air could not be safely vented.

When the line was pressured, the expected happened. The upstream end of the new line was forced out of the coupling at a pressure of approximately 700 lb., instantly changing the pressure across the stopple from a negligible differential to full line pressure. Despite the excessive pressure, the stopple did not leak.

The bent pipe was straightened, another coupling installed and the air vented. This time the coupling was welded before repressuring the system.

All stopples but the one adjacent to the point of instantaneous depressurization could be retracted. It was possible, however, to get a full flow around the partially retracted sealing element.

Stopple bent. The bypasses were closed to send the full flow through the new line. A second stopple was installed immediately above the balky stopple (Fig. 3) but its lowering was blocked by sand that had settled out of the oil. It was finally worked into place and the offending stopple and tapping valve were removed as a unit.

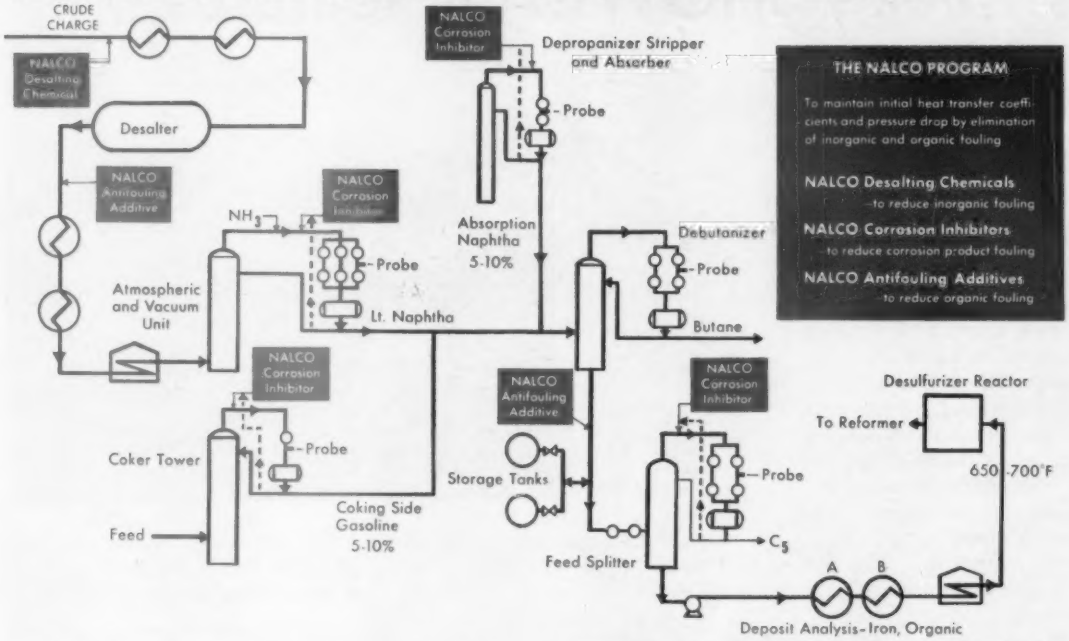
When the stopple was removed it was found to be bent (Fig. 4), probably as a result of the unpressuring of the downstream side and possibly because of the load of sand behind it. Although bent, the stopple did not leak.

Final step was the removal of valves which were replaced with Lock-O-Ring plugs. A short piece of pipe was welded to the plug as an extension and a coupon welded to the extension (Fig. 5). When these plugs were installed in the flanges on the tapping fittings the valves could be removed.

When the line pressure is increased, the old line can be used to reduce pressure drop and may be isolated at any time for repairs. When the line is looped, the old section will undoubtedly become part of the loop.

NALCO ANTIFOULING ADDITIVES

ESSENTIAL TO ANY COMPLETE DEPOSIT CONTROL PROGRAM



Fouling deposits in refinery process units have long been a costly problem to refiners. Increased maintenance costs, increased fuel costs, reduced throughput, and more frequent shutdown, all take away from profits. These troublesome deposits, however, can be reduced or eliminated with a carefully planned program.

Such a program, to be totally effective, must be a three-way attack on deposit formation. Desalting chemicals, corrosion inhibitors and antifouling additives individually may reduce deposit formation to a degree. To reduce fouling substantially, however, a combination of all three is essential. Each part of the program performs a separate and necessary function:

Desalting chemicals—remove inorganic salts from the crude, thus eliminating a major source of the inorganic components in deposits.

Corrosion inhibitors—prevent the formation of corrosion products, another major source of inorganic deposits.

Antifouling additives—inhibit formation of long-chain polymers which are the organic component of deposits, and disperse existing particles.

ORGANIC FOULING— THE MAJOR CAUSE OF DEPOSIT FORMATION

Long-chain, high-molecular weight polymers are the real villains in fouling deposit formation. They not only form deposits themselves, but also serve as a binder for inorganic salts and corrosion products to form dense, insoluble masses. Inhibiting the formation of these polymers and dispersing existing polymers are the key factors in deposit control. Nalco antifouling additives perform these functions!

THE NATURE OF ORGANIC FOULING AND ITS CONTROL

Fouling is the result of oxidation reactions involving unsaturated compounds and nitrogen and sulfur compounds usually present in the stream. These reactions form high molecular weight polymers which agglomerate and become insoluble in the refinery stream. Nalco antifouling additives inhibit these reactions, thus reduce polymer formation.

Nalco antifouling additives are more than stabilizers. They are also dispersants, which prevent agglomeration of already formed polymers so that they remain soluble in the refinery stream.

FOULING PROBLEMS? CALL NALCO

Is fouling eating into *your* company's profits? Call Nalco! Your Nalco representative has at his disposal not only effective antifouling, desalting, and corrosion inhibiting chemicals, but also the knowledge and experience it takes to help solve your problems. In addition, the facilities and technical staff of Nalco's petroleum chemical laboratories back him up. With these tools he can help you improve *your* profit picture by reducing downtime and improving unit efficiency. Write for Nalco files G-3, "Refinery Corrosion Control," G3a, "Refinery Fouling Control," and G6, "Desalting and Emulsion Breaking." Then call your Nalco representative to help you start the Nalco Program.

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In Canada: Alchem Limited, Burlington, Ontario

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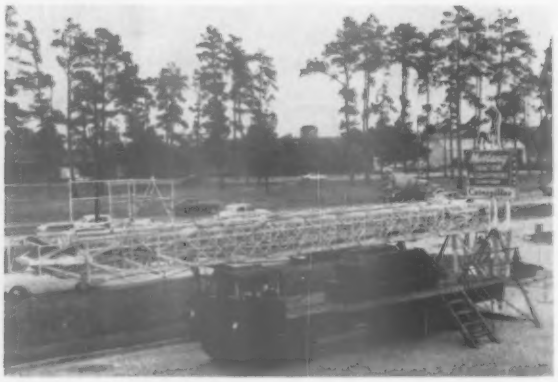
Nalco CHEMICALS
Nalco SERVICES

▶▶▶ New Equipment Section

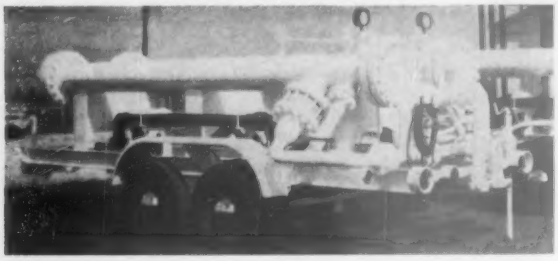
This week's SHOWCASE features . . .



Self-propelled servicing rig

. . . uses a 220-hp. diesel engine to obtain power for propulsion and to drive the draw works. Construction features include 95-ft., 187,000-lb.-capacity mast that is hydraulically raised and telescoped, forged-steel brake flanges on both the main drum and the sand-line drum, air clutch on both drums, an equalized brake system, and air controls.

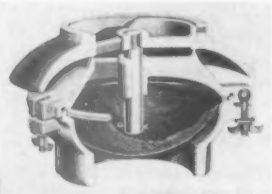
Road length of the rig is 54 ft. 1 in. It weighs 59,000 lb. and is designed to service wells up to 15,000 ft. deep. Maximum hoist pull with six lines is 222,000 lb. The tubing board has a capacity of 15,000 ft. of 2½-in. tubing. Source: **Lee Engineering Co., P. O. Box 340-Voth Station, Beaumont, Tex., U.S.A.**



Portable liquid-meter prover

. . . recently developed permits positive-displacement meters to be proved in less than an hour and eliminates start and stop errors, the manufacturer claims. The Halmor prover comes in models to handle meters in sizes to 6 in., at working pressures up to 1,200 psi., and flow rates up to 1,500 bbl. per hour. Crude, products, and LPG meters can be proved with the portable prover.

Components include a tachometer or pulse generator driven by the meter that generates 1,000, 10,000, or 100,000 pulses per barrel of throughput. This depends upon the gear ratio of the speed increaser. As fluid flows through a calibrated pipe, it displaces a plug through a known volume between two detector switches. These switches are a normally open, momentary contact type. Source: **J. A. Halpine & Son, Inc., P. O. Box 6147 Pine Square Station, Tulsa 17, Okla., U.S.A.**



Emergency vent for tanks

. . . used to store petroleum products has been announced that is designed to comply with Section 2133 of the National Fire Protection Association Code 30. The vent has a large-diameter plate in the cap which is sealed with fusible metal.

If fire occurs, the fusible metal melts at 200° F. and the plate blows off to give full upward venting. A double fire screen on the Model 209-U vent gives added protection. The vent is set to relieve at 10-oz. pressure. The maker says

Want more facts about equipment or copies of product literature described in this issue?

Send this **Showcase Coupon**

to manufacturer at address shown in bold type after each item.

Product name, Model no., literature title or number: .....

.....

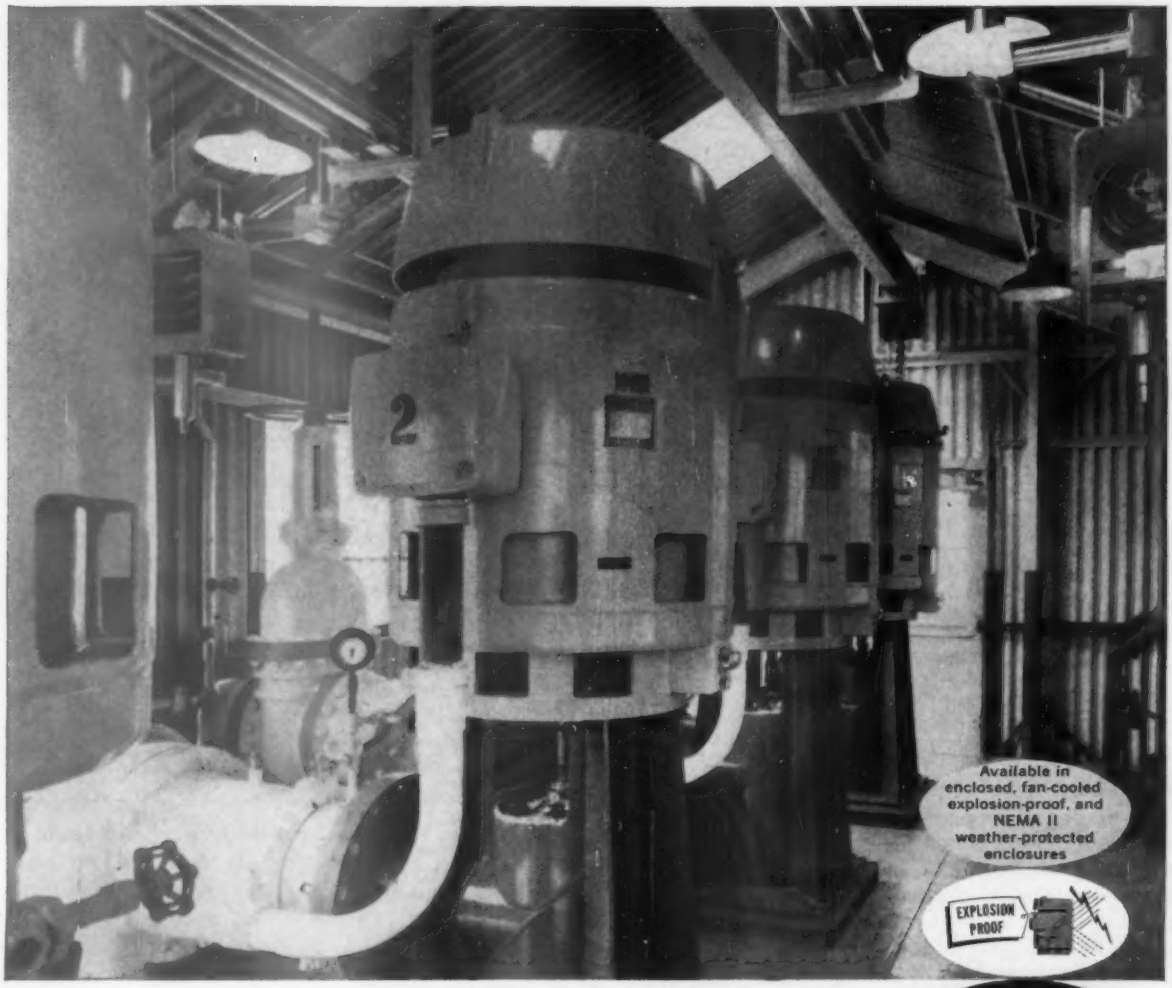
Described in OIL and GAS JOURNAL - Issue of February 20, 1961

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

CITY..... STATE.....



These motors are climatized for trouble-free pumping anywhere!

You can use Louis Allis vertical motors indoors or outdoors

These motors are job-designed to keep your pumps going regardless of their environment. Even under rough conditions and in untended locations, upkeep is extremely low.

For example, new M-G-L insulation and varnishes protect windings against corrosive gases, vapors, moisture, heat... and have high dielectric and mechanical strength for long, trouble-free life.

Louis Allis *climatized* design adds the all-weather protection. The snug but rugged housing and cover will not corrode. Wind-blown rain, snow, sand, and dirt can't get into the motor. The high-volume, low-velocity cooling system breathes air in through screened and baffled right-angle inlets. Thus dust and moisture are not drawn into the motor — nor can foreign matter, bugs or rodents get past the screen. It's extra-quiet, too.

You get duplex-mounted shaft bearings for maximum thrust capacity without misalignment. A self-releasing coupling automatically disengages the pump shaft and eliminates inadvertent damage in case of accidental motor reversal. The motor can be supplied with a non-reverse ratchet that prevents backspin when the motor is shut off and the column of water drains back.

You can choose Louis Allis vertical motors with hollow or solid shaft — in sizes up to 2000 hp. Contact your nearby Louis Allis District Office for application assistance. Or write for Bulletins 2450, 2500 and 2600 to The Louis Allis Co., 449 E. Stewart St., Milwaukee 1, Wis.

OW-205

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

New Equipment

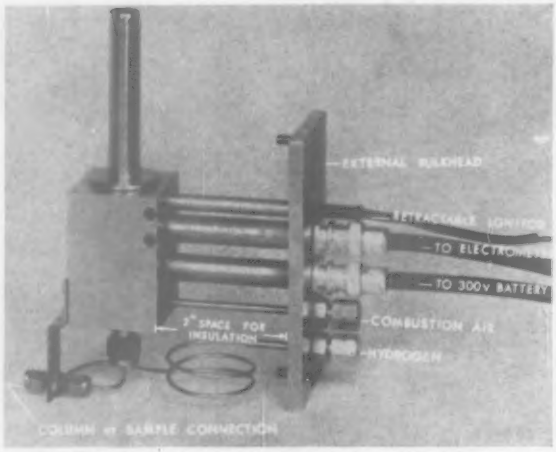
the vent should be used with a vacuum relief vent. Source: **OPW Corp., 2735 Colerain Ave., Cincinnati 25, Ohio, U.S.A.**

●

Push-button station

. . . featuring corrosionproof, weather-sealed construction being introduced is recommended by the maker for any two-station push-button application such as start - stop, up-down, forward-reverse, or on-off.

The all-rubber Flexite switch is said to meet NEMA Types 1, 4, and 5 enclosure requirements for both heavy and standard-duty operation. It incorporates microtype one or two-pole switches tailored to specifications, with normally open and/or normally closed contacts. Source: **Joy Mfg. Co., Electrical Products Div., 1201 Macklind Ave., St. Louis 10, Mo., U.S.A.**



New aid for chromatographs

. . . a high-temperature hydrogen-flame ionization-detector module, permits you to modify a gas chromatograph to flame-ionization detection, the maker says.

The module is set up so 2 in. of insulation may be used between the detector burner assembly and the bulk head which terminates connections for hydrogen, combustion air, electrometer, and high-voltage connections and flame ignitor.

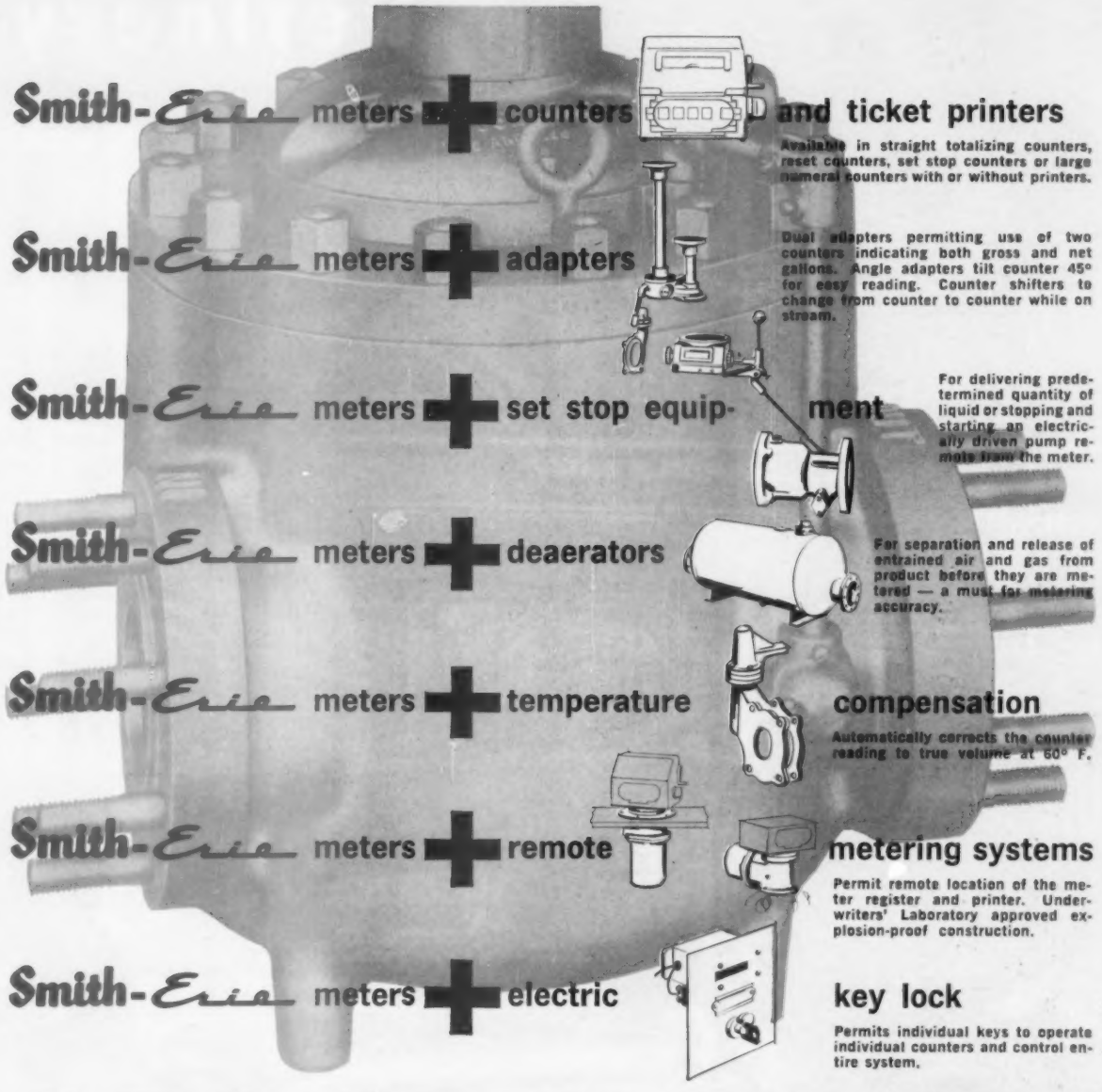
A miniature column-connection fitting is connected to the burner assembly. Sapphire collector insulation is used to permit high-performance operation. Source: **Loe Engineering Co., 2092 N. Lincoln Ave., Altadena, Calif., U.S.A.**

Cylinder type of valve operator

. . . can be adapted to outside-screw-and-yoke, iron-body-wedge or double-disk gate valves, the maker announces. The operator comes in kit form for field installation on valves in service. The maker claims the operator can be installed in 30 minutes or less.

A double-acting cylinder powered by water, air, or oil actuates the operator. A four-way valve controls cylinder operation. This valve can be placed in any convenient place with a reasonable distance from the main valve. Fixed orifices in the cylinder ports maintain an operating speed of 1 in. per second.

A piston-rod stem coupling shows valve-disk position. It can also be used for emergency manual operation of the valve. Source: **Crane Co., 155 N. Wacker Dr., Chicago 6, Ill., U.S.A.**



Smith-Erie meters + counters and ticket printers

Available in straight totalizing counters, reset counters, set stop counters or large numeral counters with or without printers.

Smith-Erie meters + adapters

Dual adapters permitting use of two counters indicating both gross and net gallons. Angle adapters tilt counter 45° for easy reading. Counter shifters to change from counter to counter while on stream.

Smith-Erie meters + set stop equipment

For delivering predetermined quantity of liquid or stopping and starting an electrically driven pump remote from the meter.

Smith-Erie meters + deaerators

For separation and release of entrained air and gas from product before they are metered — a must for metering accuracy.

Smith-Erie meters + temperature compensation

Automatically corrects the counter reading to true volume at 60° F.

Smith-Erie meters + remote metering systems

Permit remote location of the meter register and printer. Underwriters' Laboratory approved explosion-proof construction.

Smith-Erie meters + electric key lock

Permits individual keys to operate individual counters and control entire system.

ADDAPTABILITY

WITH SMITH-ERIE YOU CAN ADD AN ACCESSORY TO SATISFY ANY PETROLEUM METERING NEED

From Smith-Erie — a complete line of meters for petroleum products *and* a complete line of metering accessories. Put them together and you have the flexibility necessary to meet any liquid measurement need. See your Smith-Erie meterman for complete details.

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Here are the quality leaders, the names in refining, natural gasoline and petrochem plant equipment synonymous with performance.

When you specify pipe, valves or welding fittings made by these manufacturers, you know you are getting quality. You know that longer service life and less down time result when quality equipment is installed. We are proud to offer you these quality leaders. We know that the research and development invested in these products mean more satisfied customers for J&L.

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Specify quality.... and save at J&L.

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It's the best available

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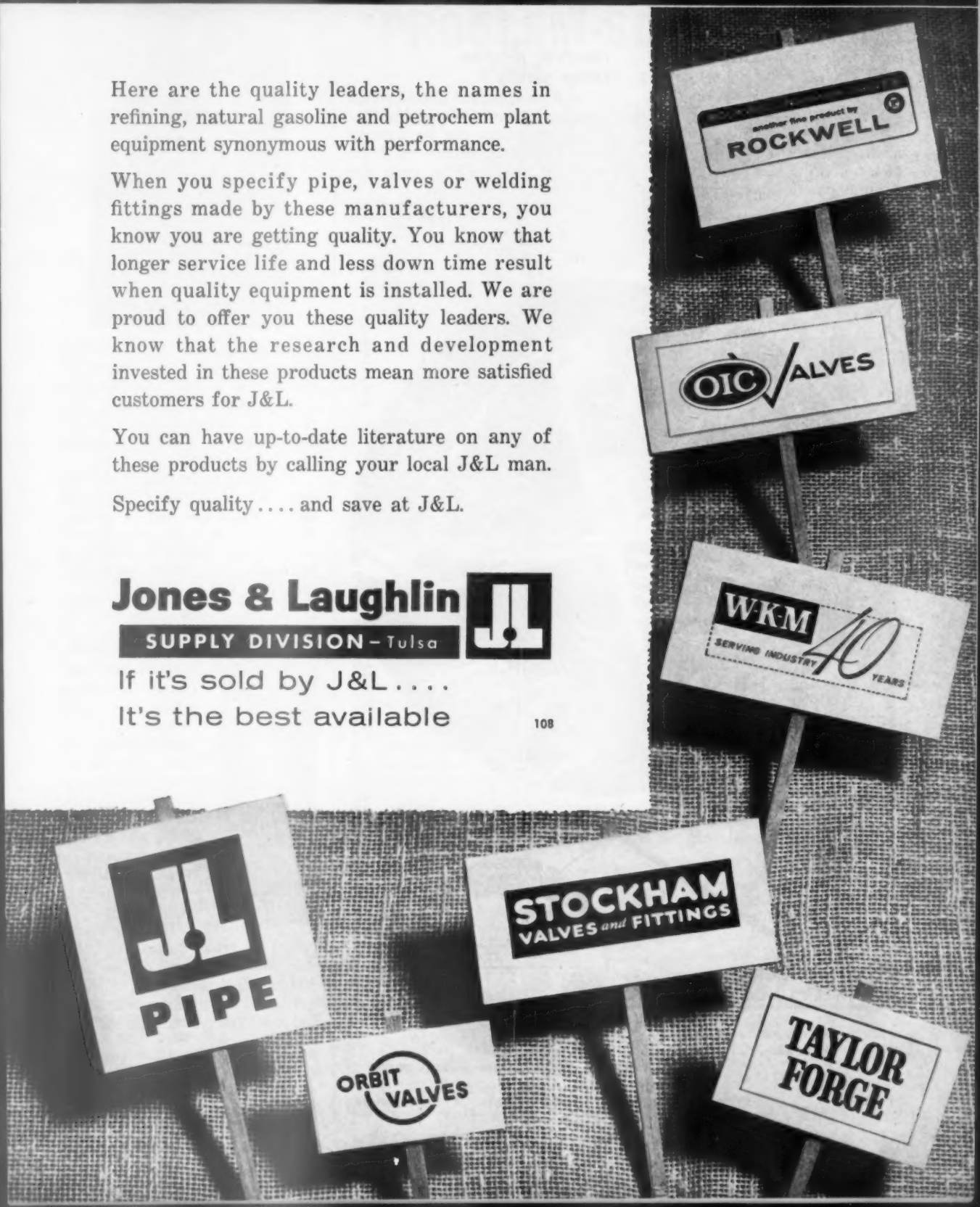

High-build vinyl coating

. . . on the market now can be applied with either conventional or airless spray equipment to provide corrosion protection for tank exteriors and structural steel. When applied with airless spray equipment, the maker says only one cross-sprayed coat of the No. 99 coating is needed to obtain a dry-film thickness of more than 5 mils.

Using conventional spray equipment, two coats are needed to produce a dry-film thickness of 5 mils. According to the maker, the coating is nonflammable, odorless, nontoxic, and will not harbor bacteria or fungi. Source: **Amercoat Corp., 4809 Firestone Blvd., South Gate, Calif., U.S.A.**

●

Narrow ditches tamp easily

. . . with an improved self-propelled earth compactor now available. The Rapak compactor can be used to tamp ditches as narrow as 4 in. wide and up to 40 in. deep, the maker says.

Design features of the machine include a "one-shot" lubrication system that is built into the head of the machine as an integral part. A sleeved, four-cycle engine powers the compactor through a centrifugal type of clutch.

According to the maker, the machine delivers 450 ram blows per minute and can be used to compact all types of granular and cohesive soils. Source: **Racine Hydraulics & Machinery, Inc., 2000 Albert, Racine, Wis., U.S.A.**

●

Computer linkage system

. . . developed which permits combining analog and digital computers into a single system. The maker says the device permits a conventional analog computer and one of several digital computers to be plugged together without individual engineering.

The device is expected to prove particularly valuable where problems require solution at speeds appropriate to analog computers and the extreme accuracy and repeatability attainable with digital computers.

Two basic systems, designated Models DS-110 and DS-113, offer 11-bit and 14-bit precision, respectively, the maker says. Both models

PIPELINE SYSTEMS
OIL GAS WATER PRODUCTS
WHERE IN THE WORLD DO YOU NEED CONSTRUCTION?
WILLIAMS BROTHERS
ENGINEERS — CONSTRUCTORS
NBT BUILDING, TULSA, OKLAHOMA / CABLE: WILLBRO
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are available with up to 30 input and 30 output channels. They are designed for use with the IBM 700-7000 Series, Bendix G-15, and the Packard Bell PB 250 computers. Source: **Packard Bell Computer Div., Packard Bell Electronics, 1905 Armacost Ave., Los Angeles 25, Calif., U.S.A.**

•

Rust, scale remove easily

. . . with a new air-powered cleaning gun now on the market which uses a series of hardened-steel needles and a spring-loaded recoil movement. The Von Arx air gun can be operated from any conventional industrial air compressor. The needles reciprocate rapidly to strike the surface being cleaned. Air flows continuously over the working surface to remove loosened particles and leave the surface visibly clean.

Nonsparking needles are available for work in flammable areas.

Cleaning action is controlled by a trigger on the handle. Normal working pressure is 88 psi. Air consumption is 12.5 cu. ft. per minute. The maker says 12 air guns can be operated from a two-stage compressor. Source: **Marindus Co., P. O. Box 286, North Bergen, N. J., U.S.A.**

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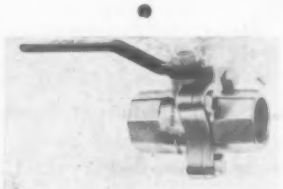
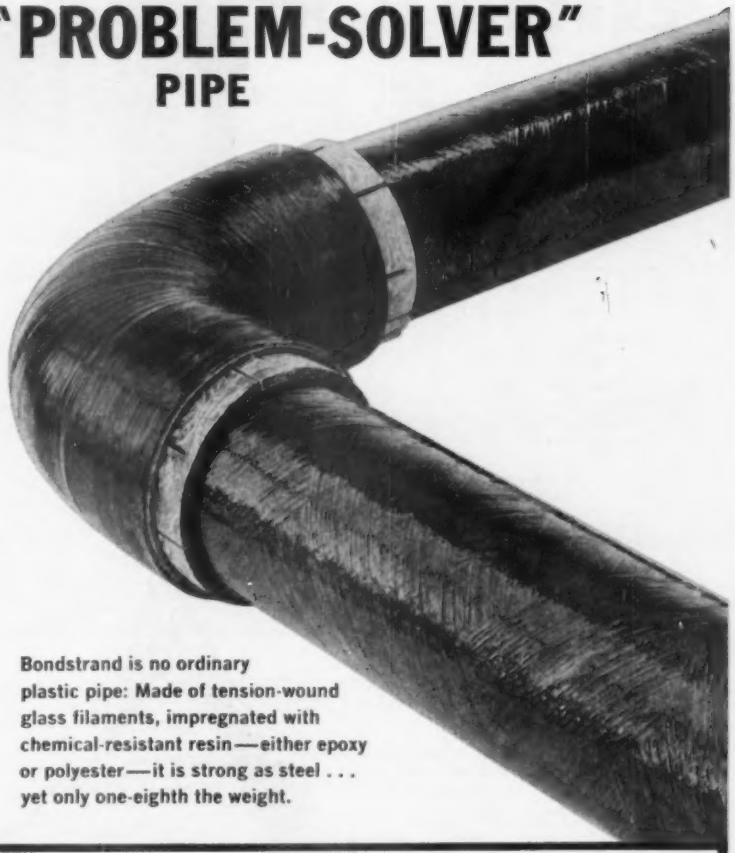


Ball valve opened fast

. . . as it needs only a one-quarter turn of the handle. The Model BL-300 valve is rated at 300 lb. for water, oil, or gas service at maximum temperature of 250° F. It comes in ½ to 2-in. sizes. Material is forged naval bronze.

The maker says the ball has a wiping action across the seats that forces out foreign material and prevents abrasive wear. The seats are made of Buna-N rubber and impregnated with molybdenum disul-

BONDSTRAND®
THE "PROBLEM-SOLVER" PIPE



Bondstrand is no ordinary plastic pipe: Made of tension-wound glass filaments, impregnated with chemical-resistant resin—either epoxy or polyester—it is strong as steel . . . yet only one-eighth the weight.

THE PROBLEM	THE LOCATION	THE SOLUTION
Carbon black slurry destroyed schedule 40 steel pipe in 30 days	Synthetic Rubber Plant	Bondstrand installed 1959. No failure. Performance still rated excellent
Chlorine Dioxide water caused failure in stainless steel pipe	Paper Plant	Bondstrand installed 1958. Performance still rated excellent
10% Ferric Chloride solution destroyed ordinary steel or stainless	Sewage Treatment Plant	Bondstrand installed 1958. Performance still rated excellent
Salt water well injection at 1600 psi	Petroleum Production	Bondstrand installed 1958. No failure. Performance still rated excellent

Bondstrand's total installed cost can be actually competitive with ordinary carbon steel pipe. Write for bulletin containing physical and design data.

Amercoat® CORPORATION

132A

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921 Pitner Ave. Evanston, Ill. | 360 Carnegie Ave. Kenilworth, N.J. | 111 Colgate Buffalo, N.Y. | 2404 Dennis St. Jacksonville, Fla. | 6530 Supply Row Houston, Tex.

That's the amount of catalyst that Buell cyclones are collecting in fluid cat crackers every day . . . enough to build a pyramid the size of the Great Pyramid of Cheops. Operating experience has convinced refineries to rely on Buell Cyclone Systems for minimum catalyst loss. Buell systems for fluid bed processing include: fluid catalytic cracking units, hydroforming, coking, coal carbonization, iron ore reduction. To meet the most stringent air pollution codes refineries also prefer a combination system with Buell Electric Precipitators. Buell Engineering Company, Inc., Department 61-B, 123 William Street, New York 38, New York; Northern Blower Division, 6405 Barberton Avenue, Cleveland, Ohio. Cyclones • Electric Precipitators • Bag Collectors • Combination Systems • Classifiers • Fans

buell Norblo

fide to give a nongalling surface. Two O-rings seal the stem against leaks. Source: **R-P&C Div., American Chain & Cable Co., Inc., Tulpenhocken St., Reading, Pa., U.S.A.**

•

Repair kit for valves

. . . pumps, and other equipment recently put on the market consists of two self-measuring tubes. One contains the maker's product, tradenamed Devcon F.; the other a hardening agent. Equal lengths of each tube are mixed and then applied to the parts to be repaired. The resulting mixture contains about 80% aluminum and 20% epoxy resins and modifiers.

According to the maker, the mixture does not shrink and has strong adhesion to steel, iron, aluminum, bronze, and glass. Source: **Devcon Corp., Danvers, Mass., U.S.A.**

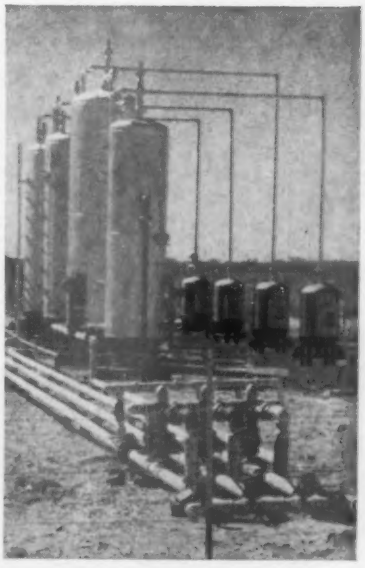
•

Digital-pressure transducer

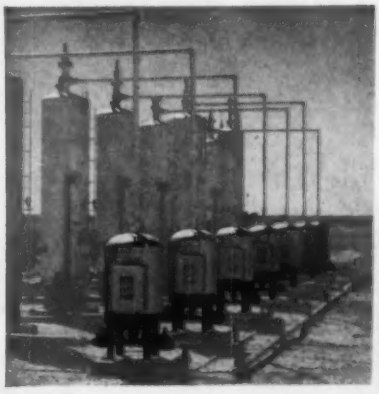
. . . offers a way to continuously and accurately monitor gas and liquid pipelines through printed records and warning alarms, the maker says. The Series DX-100 transducer indicates, in digital form, the magnitude of pressure inputs.

Packaged in a metal enclosure suitable for wall mounting, the typical unit contains an input pressure element, force amplifier, shaft-position encoder, motor, power supply, mechanical linkages, and terminal strips for electrical connections, the maker says. An appropriate input pressure element required to span the required range is used. Source:

METROL®
"CV" VOL-U-METERS®



◀ METROL Model 10-CV-01 Vol-U-Meters metering and commingling oil from four separate royalty interests into a common tank battery.



▲ METROL 10-CV-01 Vol-U-Meters metering and commingling oil from seven dual completed wells into a common tank battery.

METROL® "CV" VOL-U-METERS® are designed for accurate metering of crude oil and water by cyclic accumulation, isolation and discharge of equal volumes.

METROL "CV" VOL-U-METERS are available in standard sizes, ¼, ½, 1, 2, 5, 10, 20 and 30 barrels per dump. Standard working pressures are 125, 300, 600 and 1200 psi. Capacities are shown in table below.

Metering accuracy of METROL "CV" VOL-U-METERS depends on proper liquid level control and proper valving, both of which are obtained and maintained. Accuracies of 99.99% are common. This accuracy is attributed to the vessel's patented snap-acting pilot mechanism.* Pilots used on VOL-U-METERS are reliably accurate and react at exact preset upper and lower levels. VOL-U-METERS are approved by most regulatory bodies for measuring oil for royalty and tax payments, testing wells, and commingling oil.

Average repair parts cost for METROL "CV" VOL-U-METERS is less than $5.00 per unit per year! Ruggedness and simplicity of these units, added to their high accuracy and dependability, make them the best meter for metering crude oil upstream of lease storage tanks.

Accurate metered volumes, low maintenance cost, trouble-free operation, efficient and accurate handling of production, increased field safety, and additional lease automation are among advantages provided by METROL "CV" VOL-U-METERS.

UNIT MODEL NO.	2½ CV	5 CV	10 CV	20 CV	50 CV	100 CV	200 CV	300 CV
Volume per dump, Bbl.	¼	½	1.0	2.0	5.0	10.0	20.0	30.0
Metering Capacity BPD								
Rated	300	500	720	1,440	2,000	4,000	8,000	15,000
Maximum	500	650	1,200	1,800	3,000	5,000	12,000	20,000
Avg. Expected Metering Accuracy, Percent	99.80	99.90	99.95	99.97	99.98	99.99	99.99	99.99

Every Unit is completely assembled, pressure tested, calibrated, and performance tested before shipment.

Competent Sales and Service Representatives located in all major oil areas.

*Pat. No. 2,818,738

OIL METERING and Processing EQUIPMENT CORP.
MELROSE 5-1226 • 4843 YALE STREET
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WHEREVER STREAM BLENDING IS INVOLVED

Automatic stream blending is our business . . . whether it be a simple two component system or a multicomponent system for blending gasolines, jet fuels, solvents, lube oils, waxes, residual fuels or asphalts. Performance-proved Proportioneers blending systems are designed by men who recognize a problem and dare to pioneer new concepts. With 30 years of field application and manufacturing experience, B-I-F offers the petroleum industry the most comprehensive source of stream blending data available.

Through constant research in continuous processing, B-I-F has developed a wide line of compatible system components. From this line, B-I-F can custom-build a stream blending system to accommodate your most exacting specifications at minimum cost.

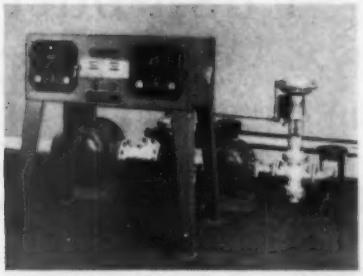
Continuous automatic blending systems offer greater operational flexibility, provide tailor-made end products on the spot, reduce intermediate tankage and end product storage. If you have a blending problem, find out how a B-I-F engineered system can add more profit to your operation! Write **B-I-F Industries, Inc. 377 Harris Avenue, Providence 1, Rhode Island.**

Industries

BUILDERS-PROVIDENCE • PROPORTIONEERS • OMEGA

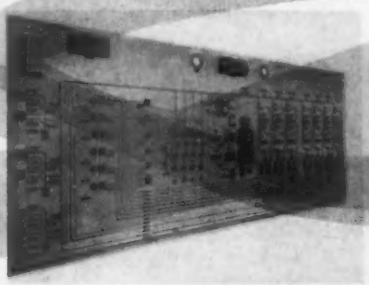
METERS • FEEDERS • CONTROLS / CONTINUOUS PROCESS ENGINEERING

FUEL OIL Base stocks at terminals or loading racks are blended at twist of a dial . . . directly from storage to tank trucks, tank cars or barges . . . automatically, safely, accurately!



ASPHALT Penetration blends or asphalt cutbacks are continuously blended in a single-pass operation at loading racks direct to tank truck without intermediate storage and within state specification.

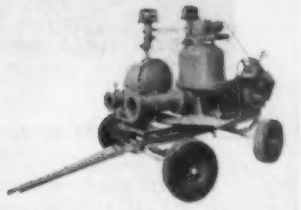
LUBE OIL Continuous recirculation-type fail-safe Panel Blenders . . . compound specification lubes and additives at minimum production costs . . . increase operating efficiency and formulation accuracy . . . reduce tankage.



GASOLINE Explosion-proof Panel Blenders, close-coupled or remote, continuously proportion base stocks, dyes, additives, and TEL with fingertip control over any formulation in any quantity. Error-free, fail-safe operation.

ADDITIVES A complete line for automatically proportioning additives to gasoline, lubricating oils, fuels, etc.; including economical proportioning pumps and flow responsive metering systems.

JET FUEL Automatic in-line Panel Blender . . . remote transmission . . . minimum installation cost, maximum flexibility, high accuracy, economical fingertip formulation.

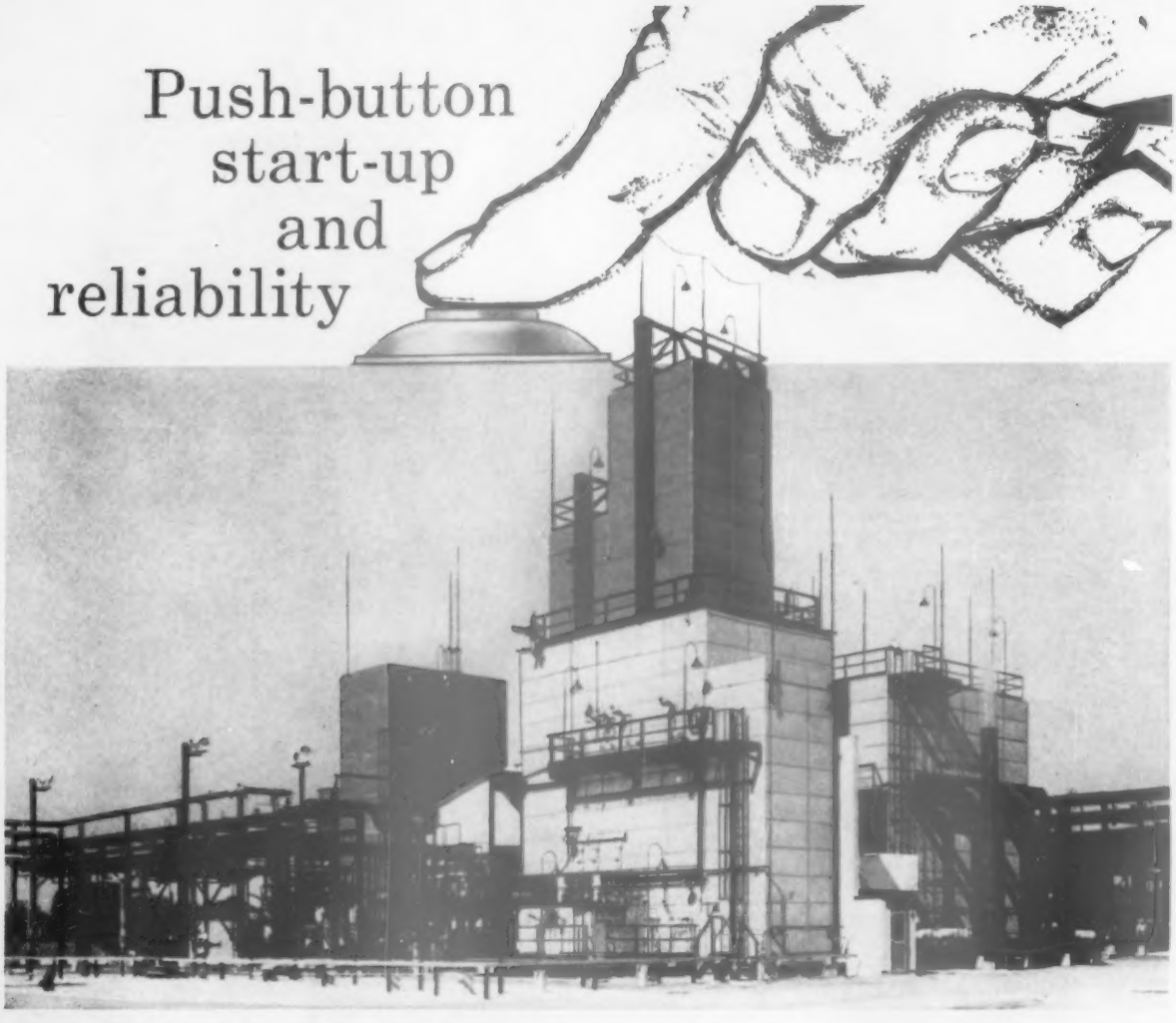


BUNKER FUEL Mobile units . . . for continuous, automatic, "on-the-spot" blending of specification bunker fuels directly from base stock storage to ships' bunkers.

ELECTRONIC BLENDING In multicomponent blending systems, the B-I-F Electronic Console provides remote operation with maximum control in minimum space at minimum cost. Entire blending operation, supervised by a single qualified technician, effectively provides "Laboratory Control" of entire operation. Is applicable in the gasoline, lube oil and jet fuel operations illustrated above.

YOU NAME IT! When it comes to stream blending, a B-I-F specialist is ready to recommend and furnish estimates. See Thomas Register or Chemical Engineering Catalog for your nearest B-I-F representative.

Push-button start-up and reliability



FULL CAPACITY IN 48 HOURS. *Push-button start-up* — the ultimate aim of every plant engineer and designer — takes a lot of experience, particularly in the low-temperature separation field. Air Liquide has that experience: more than fifty years of designing and building all types of low-temperature separation plants.

Here is an example: a large high-purity oxygen plant (*above*) located in Texas. Designed and built by Air Liquide to produce close to 400T/D of 98% oxygen plus a stream of high-purity nitrogen, this plant was in full production *only 48 hours after completion of pressure testing*. Furthermore, extreme flexibility of operation was proved during acceptance tests with completely satisfactory operation over all its designed range, with oxygen purity up to 99.6% and nitrogen purity of less than 100 ppm.

Fabricated of stainless steel and aluminum, equipment and piping were engineered so that a field team could erect the plant with maximum efficiency, yet without modifying the basic principles of low-temperature design.

Air Liquide cryotechniques provide a complete low-temperature gas separation service to industry: process and project engineering of complete plants and custom-designed equipment, technical consultation for special requirements, manufacturing of plants and equipment, plant erection and start-up supervision.

* ALL AIR LIQUIDE LOW-TEMPERATURE PLANTS ARE DESIGNED AND BUILT IN NORTH AMERICA FROM NORTH AMERICAN MATERIALS — TO NORTH AMERICAN STANDARDS

Plants designed and built by Air Liquide include:

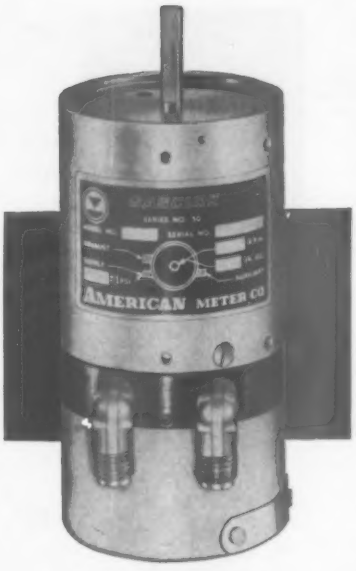
• Air Separation — oxygen, nitrogen, etc. • Tonnage Oxygen and Nitrogen (gas and liquid) • Rare Gases Recovery • CO_2 Purification • Methane Purification • Natural Gas Liquefaction • Hydrogen Liquefaction • Hydrogen Recovery for Ammonia Synthesis Gas • Coke-Oven Gas Separation • Helium Recovery • Refinery Gas Separation • Pure CO Production • Heavy Water for Atomic Reactors.

For complete information write or call

AMERICAN AIR LIQUIDE
ENGINEERING & CONSTRUCTION DIVISION
OLDEST IN EXPERIENCE NEWEST IN DESIGN

Chrysler Building, 405 Lexington Ave., New York 17, N.Y. Telephone: YUkon 6-6544

In Canada:
L'Air Liquide, 1210 Sherbrooke St. W., Montreal, Quebec. Telephone: Victor 2-5431.



AMERICAN®

GASCLOK

POWER

DRIVE

Completely self-contained gas or air-powered instrument driving and timing unit for long, trouble-free operation in remote locations. The GASCLOK delivers more than 20 times the torque of conventional spring-wound mechanisms. Continuous timing accuracy is unaffected by a ± 20% variation in supply pressure.

Inherently explosion proof and self-starting, the GASCLOK is ideal as original or replacement equipment for strip chart and conventional circular chart instruments. The timing mechanism is internally sealed to prevent corrosion, and all power unit parts exposed to gas are aluminum or stainless steel. Large area internal ports prevent clogging. Normal air or gas consumption 5 cfh . . . operating pressure 5 psi . . . rotation 2 rpm.

AMERICAN®
METER COMPANY
INCORPORATED (ESTABLISHED 1836)

Executive Offices: Philadelphia 16, Pa.
Sales offices in principal cities.

Datex Corp., 1307 S. Myrtle Ave., Monrovia, Calif., U.S.A.

•

Latest drilling fluid

. . . to be announced, called Hydro-gel, is a no-solids type of drilling-and-workover fluid which the maker claims gives maximum viscosity with minimum water loss.

As described by the maker, the product is a free-flowing white powder that can be mixed through a hopper, hydrates in hot or cold water at normal pH levels, forms a viscous no-solids fluid with as little as ½ lb. per bbl., and gives API funnel viscosity of 55 seconds in salt water at 2-lb. per bbl. concentration, and gives fluid-loss control at ½ lb. per bbl. The product comes in 100-lb. heavy-duty, paper-lined, burlap sacks. Source: **Oil Center Research, Inc., P. O. Box 1871, O.C.S., Lafayette, La., U.S.A.**

•

Micrometer type of valve handle

. . . is now available for the Nupro line of metering valves. The handle is set at zero with the valve closed. As the valve is opened, the axial position of the stem can be read to one thousandth of an inch, the maker says. The handle is made of stainless steel and plated with silver mist chrome. Source: **Nuclear Products Co., 15635 Saranac Rd., Cleveland 10, Ohio, U.S.A.**

•

Ashless detergent additive

. . . has been announced which is claimed to be completely ashless. The additive is offered alone or in formulations known as Oronite 1200 series which incorporate a zinc-phosphorous containing oxidation inhibitor. According to the maker, the additive was developed specifically for low-temperature (stop-and-go) gasoline-engine service conditions and provides good high-temperature gasoline and diesel-engine performance. Source: **California Chemical Co., Oronite Div., 200 Bush, San Francisco, Calif., U.S.A.**

Dowell Paraffin Solvent . . . a low-cost solution to an expensive problem

Dowell Red Paraffin Solvent is a non-chlorinated, oil-soluble material designed to dissolve paraffin accumulations . . . even when complicated by asphalt, salt, sand, gum or wax. Dowell solvent is chemically neutral. It contains no acid.

Dowell Red Paraffin Solvent weighs 10.4 pounds per gallon. It is often used at its full concentrated strength. However, it may be diluted easily with kerosene, gasoline, benzene or xylene to provide an effective, low-cost solvent for specific paraffin problems.

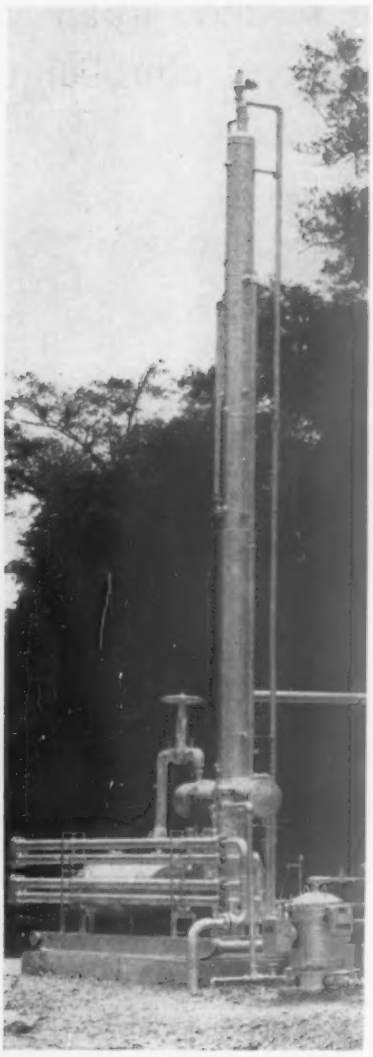
Dowell Paraffin Solvent is available at all Dowell stations and many oil field supply stores in convenient 10-gallon steel drums.

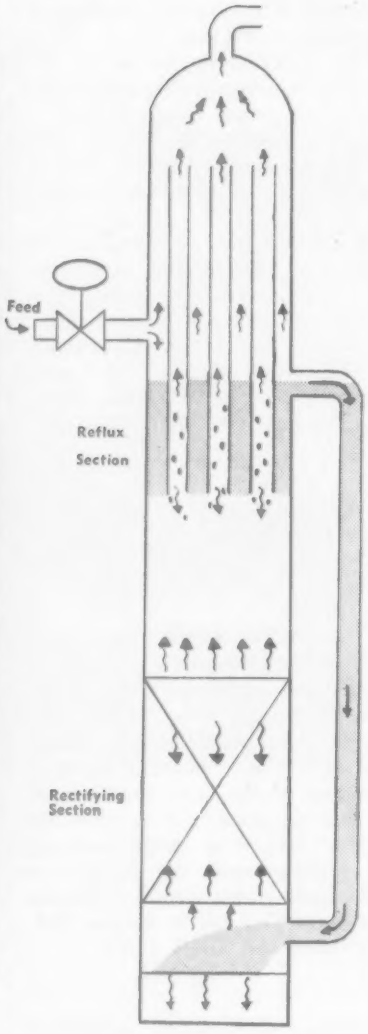
PRODUCTS FOR THE OIL INDUSTRY

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

Maloney-Crawford's New Auto Reflux Stabilizer Can Increase Condensate Income Up To 25%

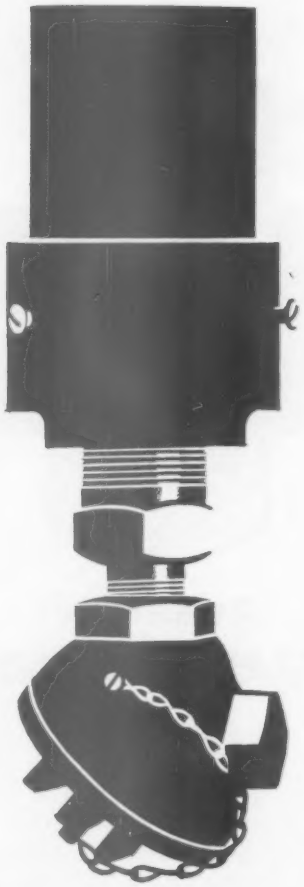




The Maloney-Crawford Auto-Reflux stabilizer has been field-proven to increase condensate sales up to 25 per cent even with lower operating pressures and inlet feeds as high as 85 F. M-C has broken the inlet temperature barrier with a patented feed exchange system built into the top of the column, as shown in the simplified drawing above. This unique system utilizes the throttling cooling of the feed to provide a rectification section and to reflux the column. It is especially well suited for use downstream from hydrocarbon recovery units and gas plants. Write for full details!

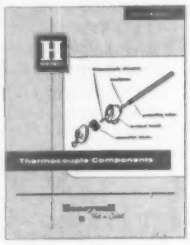
Maloney-Crawford

Box 659 **Tulsa**



THERMOCOUPLE COMPONENTS

Wires, insulators, protecting tubes, heads, blocks, connectors and miscellaneous components—supplied in countless combinations, for highest possible accuracy in any given application. Thermocouple components are among many thousands of accessories—all available from a single dependable source—that can help your instruments perform at their very best.



Get complete details from your nearby Honeywell field engineer, or write today for Catalog G100-3.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

Honeywell

First in Control

SHOWCASE . . .

New Literature

Packaged hydraulic systems

. . . for solving a range of process-control problems is the subject of a new six-page bulletin just announced. Bulletin I-5802 gives illustrations of typical packaged systems and installations. It includes advantages of hydraulics in process control and illustrates conventional components. Source: **Vickers, Inc., 1402 Oakman Blvd., Detroit 32, Mich., U.S.A.**

Electric hydrometer

. . . known as the Liquidensitometer, is detailed in new 16-page Bulletin 522-A now available. Among applications described are those which require direct measurement of liquid density either to directly indicate density (or specific gravity), or to provide gravimetric correction for liquid flow or tank-contents indicating systems. The instrument's applications include use in true-weight-liquid-quantity gaging systems for storage tanks, fuel trucks, and other systems requiring liquid-weight measurement. Source: **Liquidometer Corp., 39-20 Skillman Ave., Long Island City 1, N. Y., U.S.A.**

Controlled-volume pumps

. . . which are motor-driven are outlined in a revised 32-page publication, just released and available to interested persons. Bulletin 553-2 features a selection-data guide, materials-selection charts, and capacity-pressure-selection tables. Source: **Milton Roy Co., 1300 E. Mermaid Lane, Philadelphia 18, Pa., U.S.A.**

Cast-tooth sprockets

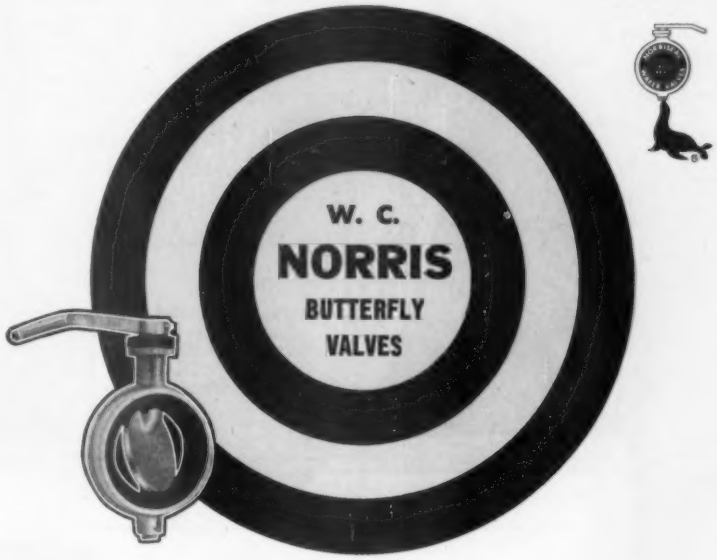
. . . stock sizes are listed in new 12-page Brochure 2867 just released. Cast-tooth-sprocket teeth are ground to fit the chain, and selection data in the literature is based on this "sprocket-to-chain" relationship. A hundred and thirty-two chain numbers are listed and cross-referenced to 48 sprocket lists. The booklet, offering a complete range of types and sizes and, considering all the various permutations, permits selection from over 30,000 sprockets in stock. Source: **Link-Belt Co., Prudential Plaza, Chicago 1, Ill., U.S.A.**

Double-pipe heat exchangers

. . . installation and maintenance manual gives the correct method of installing the conventional as well as newer types of multitube and low-pressure heat exchangers. Eight-page Bulletin 120 offers a parts list and recommended spare-parts inventory for each type. Also detailed are cross-sections with all parts identified and disassembly procedure for cleaning and inspection. Source: **Brown Fintube Co., 300 Huron St., Elyria, Ohio.**

Mastic protective coating

. . . for corrosion prevention—called Pioneer 1008 vapor seal—is outlined in a new four-page bulletin. The product is a blend of asphalts, petroleum resins, plasticizers, asbestos, mica, and solvents. The bulletin offers physical-property data, a chart for calculating the number of gallons needed to provide specific



Target

Versatility-Economy

Now you can reduce costs and simplify valve specifying by using the highly versatile and economical Norriseal Wafer Type Butterfly Valve. Designed for working pressures to 150 psi, the Norriseal Valve features removable and interchangeable rubber and metal seats . . . takes up less line space . . . can be easily and quickly removed for "on-the-spot" maintenance . . . is field repairable. The wide selection of trim available qualifies the Norriseal Valve for use in many oil field and industrial applications.

Write for prices and complete literature today!

BUY FROM YOUR NORRIS DISTRIBUTOR

NORRIS QUALITY Butterfly Valves

W. C. NORRIS DIVISION
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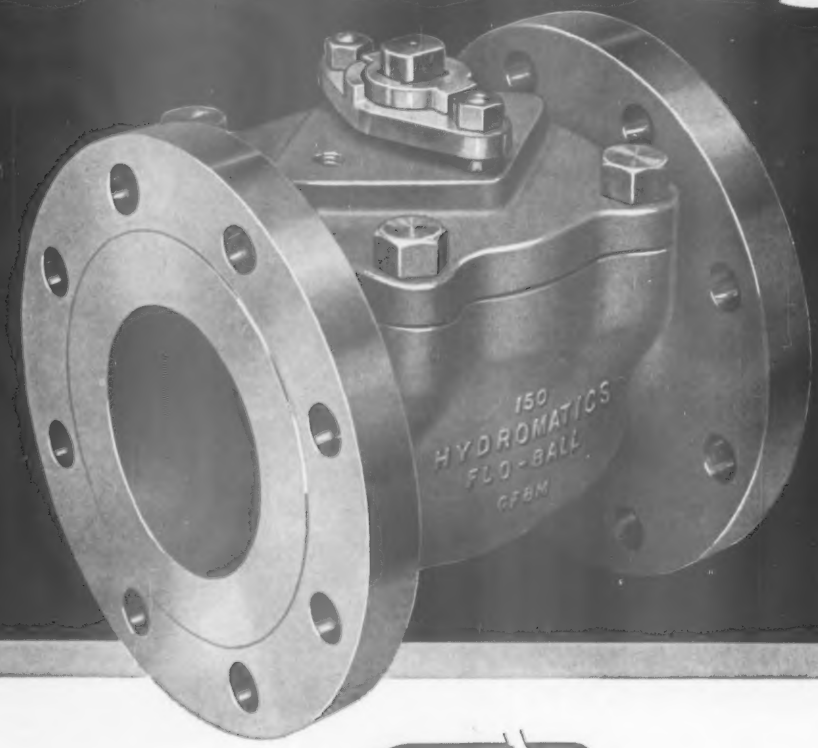
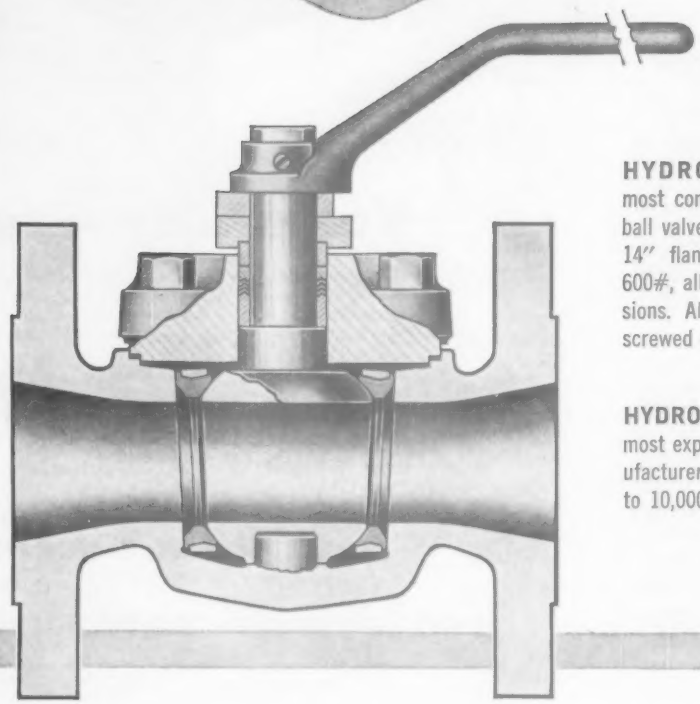
P. O. BOX 1739 • TULSA, OKLA.

BRANCHES: Great Bend, Houston, Kilgore, Odessa, Wichita Falls, Salem, Casper, Farmington

How to buy





HYDROMATICS offers the most complete line of industrial ball valves, including 1″ through 14″ flanged, 150#, 300# and 600#, all built to A. S. A. dimensions. Also available: ⅛″—2″ screwed end valves to 3000#.

HYDROMATICS is the world's most experienced ball valve manufacturer, having built ball valves to 10,000 psi and 14″.

a ball valve!

Check these features!

	FLO • BALL	VALVE A	VALVE B	VALVE C	VALVE D	VALVE E
1. TOP ENTRY	√			√		
2. IN-LINE MAINTENANCE	√			√	√	
3. TOP AND BOTTOM GUIDED BALL	√					
4. DOUBLE SEATS	√	√	√	√	√	√
5. FLANGES INTEGRAL WITH BODY	√	√		√		
6. ONE-PIECE BALL AND STEM	√					
7. BLOCK AND BLEED	√					
8. COMPETITIVELY PRICED	√	√	√		√	√

Only FLO·BALL Has All 8

In addition to these outstanding features, the **FLO•BALL** valve, with all teflon seats and seals, offers all of these advantages which make it far superior to other types of valves: fast ¼ turn, minimum pressure drop, leakproof shut-off, visible on-off indication, no backlash, and the lowest torque of any valve. The **FLO•BALL** can never stick or freeze, and it lasts longer, with less maintenance, than any other valve made.

SEE YOUR LOCAL DISTRIBUTOR FOR DETAILS AND PRICES, OR WRITE TO:

Hydromatics, Inc.

BLOOMFIELD, N. J. • PILGRIM 8-7000 • TWX = BLOOMFIELD, N. J. 120

FLO-BALL

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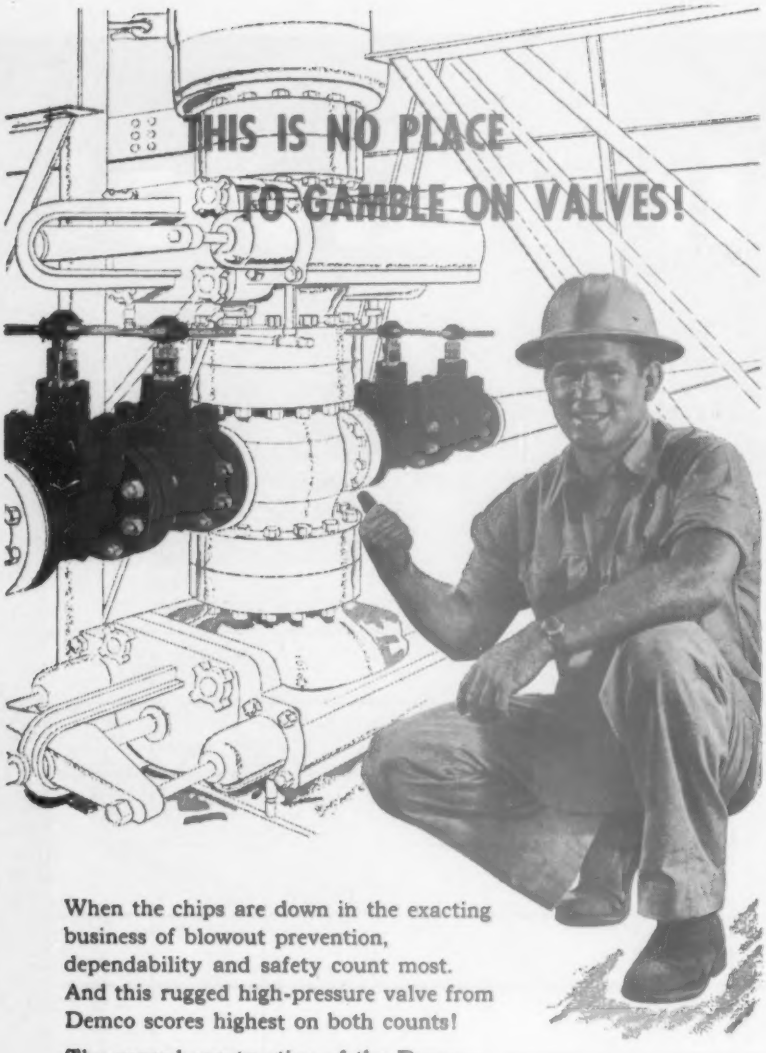


When the chips are down in the exacting business of blowout prevention, dependability and safety count most. And this rugged high-pressure valve from Demco scores highest on both counts!

The rugged construction of the Demco Valve assures its reliability—it *holds every time* against the high pressures of an unexpected flow. You get a positive rubber-to-metal seal without applying undue torque to the stem—a drop-tight seal that you can depend on.

And no matter when you need it, the Demco valve will always operate easier. Fewer parts are subject to wear. Stem threads are constantly self-lubricated and are protected from abrasives with *double* stem seal.

When you choose a valve for blowout prevention application, choose reliability, rugged construction and sure-seal safety. Choose Demco!

Available at supply stores everywhere in 1,000, 2,000, 3,000 and 5,000 psi working pressures . . . in two- to four-inch sizes.

DRILLING EQUIPMENT MANUFACTURING CO.

845 S. E. 29th Street • OKLAHOMA CITY

DEMCO

film thicknesses over unit coverage areas, application procedures, insulation values, and instructions for incorporating colored granules. Source: **Witco Chemical Co., Inc., 122 E. 42nd St., New York 17, N. Y., U.S.A.**

Corrosion-resistant tube fitting

. . . called the Ridg-lok flareless tube fitting, made in stainless steel, is illustrated and described in new Bulletin 4323B1. Diagrams of shapes with nomenclature and size tables provide ordering information. Source: **Parker Fittings & Hose Div., Parker-Hannifin Corp., 17325 Euclid Ave., Cleveland 12, Ohio, U.S.A.**

Indicating, transmitting rotameter

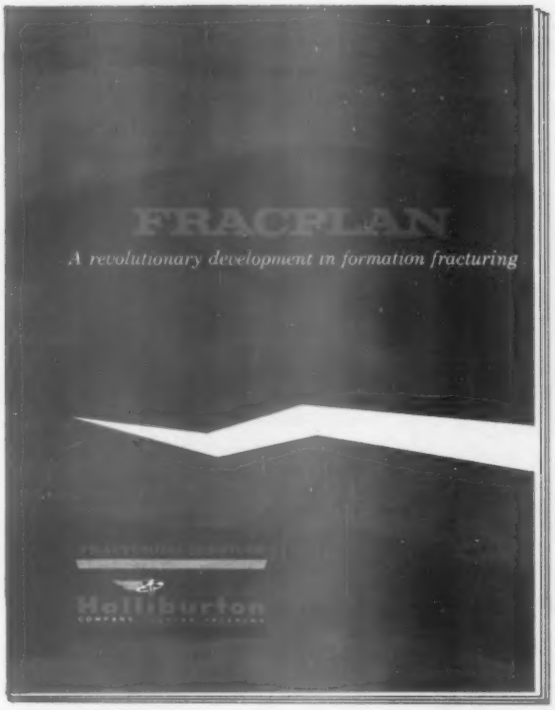
. . . the Magnarator, a throughflow pneumatic type, is described in a six-page catalog. It states that the mounting of the 3 to 15-psig. transmitter alongside the metering tube eliminates both the need for an extension and any change in direction of the fluid flow. Catalog 10A2150 (six pages) explains that range, accuracy, predictability, special materials, viscosity immunity, and other characteristics of the rotameters are retained. Source: **Fischer & Porter Co., 716 Jacksonville Rd., Warminster, Pa., U.S.A.**

Digital-recording systems

. . . brochure describes applications for tape-recording techniques in a 20-page form. Applications detailed include communications, filing, media conversion, acquisition and reduction, and high and low-speed sampling. The literature also gives functional and block diagrams. Source: **Industrial Systems Div., Minneapolis-Honeywell Regulator Co., 10721 Hanna St., Beltsville, Md., U.S.A.**

Anodized aluminum grilles

. . . specification manual provides product specifications on a wide choice of conventional geometric patterns, dimensions, and colors on this exterior-interior, decorative-structural material. Construction details of different applications of new Anotec architectural anodized aluminum grilles are illustrated with technical drawings. Source: **Klemp**



Improved fracturing results through new scientific techniques... that's FRACPLAN

FRACPLAN, the revolutionary new development in formation fracturing by Halliburton, is being met with enthusiastic acceptance throughout the industry! This new approach to the design and programming of a fracturing treatment is intended to help increase the production stimulation results through advance selection by you upon our recommendation for...

THE PROPER FRACTURING FLUID based on evaluations of the formation core and fluids.

THE "PAD VOLUME" of low fluid loss fluid which precedes the propping particles and fracturing fluid.

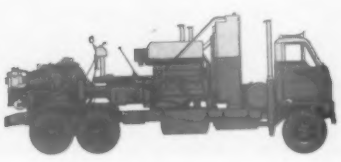
THE TYPE AND OPTIMUM AMOUNT OF PROPPING AGENT to give high fracture flow capacity based on compressive and flow capacity tests with propping particles placed between sections of core from the formation to be treated.

THE ADDITION RATE at which the propping agent will be added during injection to permit even distribution of the propping particles throughout the fracture.

Basic descriptions of laboratory procedures, formulae, selection methods, and information needed from the well owner are included in the new FRACPLAN Brochure now being distributed by *your* Halliburton man. Get your copy now from him or write to the Halliburton Company, Duncan, Oklahoma.

first and still foremost in formation fracturing

FRACTURING SERVICES



Halliburton
COMPANY · DUNCAN, OKLAHOMA

Refinery gets crude tower nearly 100% clean . . . chemically

Could results as good as 85% clean be made even better in cleaning crude oil deposits from vacuum tower? The Oakite engineer thought so. He revised one refinery's ECP*.

For next turnaround, he recommended circulating a solution of Oakite 77 and Oakite Acalaid through the tower. Meanwhile, the heat exchangers were soaked and steamed. Then reversing procedure the solution circulated through the heat exchangers while tower was steamed. This kept up for 15 hours —followed by rinsing and inspection. Results: 99% perfect. In just 21 hours, tower and exchangers were cleaner than they'd ever been.

This job proves again that an *engineered* cleaning program means not only more efficient but also more profitable operations.

*Oakite ECP is a comprehensive cleaning program engineered to fit your particular operation under the experienced supervision of a local Oakite man. ECP covers every cleaning need. For details, write Oakite Products, Inc., 44C Rector Street, New York 6, N. Y.

OAKITE
over 50 Est. 1909 years' leadership in industrial cleaning
SCIENCE

OAKITE ECP benefits you from the ground up . . .

at drilling site it speeds such salvage operations as paint stripping, rust removal, degreasing

it restores pipeline efficiency through chemical cleaning... it simplifies pump station housekeeping

International, 1132 W. Blackhawk St., Chicago 22, Ill., U.S.A.

Catalog for hoists

. . . now available, contains specification tables for various models in lever, power (electric and air), and hand-chain basic industrial hoists. Included in eight-page Catalog 600 are specification tables for hoist accessories and I-beam-trolley attachments. Source: **Coffing Hoist Div., Duff-Norton Co., Gateway Four, Pittsburgh 22, Pa., U.S.A.**

Bulletin details pH meter

. . . the Model N, a portable instrument which measures over the full 0 to 14 pH range or makes mv. measurements from 0 to 420 mv. Readings are accurate to 0.1 and repeatable to 0.03 pH, according to Bulletin 720-C. Included are descriptions, features, applications, specifications, ordering data, and photos. Source: **Scientific & Process Instruments Div., Beckman Instruments, Inc., 2500 Fullerton Rd., Fullerton, Calif., U.S.A.**

New bulletin on actuators

. . . illustrates and describes Series B-10 and B-20 spring and diaphragm actuators, available from factory in complete valve assemblies to customer specifications. Bulletin B-1020-7 shows the units in various typical combinations including a butterfly valve, adjustable port valve, and burner valve. Complete specifications, operating characteristics, and dimensions are listed. Source: **Conoflow Corp., 2100 Arch St., Philadelphia 3, Pa., U.S.A.**

New snap-on guide

. . . which can be attached to any part of a sucker rod between couplings, is discussed in a new four-page literature piece just made available. Made of abrasion-resistant synthetic rubber or nylon, the guides are said to eliminate or greatly reduce numerous downhole problems. The publication offers specification tables for nylon and rubber rod guides, fluted tubing stabilizers, nylon and rubber sucker-rod guides, and fluted guides. Included are recommended installation procedures. Source: **Oil States Rubber Co., Drawer 152, Arlington, Tex., U.S.A.**

Oil company reports PERFORMANCE PLUS with Sumitomo steel tubing

A leading drilling company in Texas reports that Sumitomo tubing far exceeded API specifications when run as drill string, despite 46 rugged round trips in and out of a 5700-ft. well under 1200-lb. mud pressure.

Performance like this shows why Sumitomo steel pipe and tubing, produced in accordance with API, ASTM and many other international standards, are exported in all sizes and grades to every major part of the world.

Available in API Standards in the following sizes:

Casing 4½" to 13⅜" O. D.
Tubing 1.660" to 4½" O. D.
Line Pipe 0.840" to 14.00" O. D.
High Test Line Pipe 6⅝" to 14.00" O. D.

LEADING MANUFACTURER OF STEEL TUBES AND PIPE WIRE RODS AND ROLLING STOCK PARTS

SUMITOMO METAL INDUSTRIES, LTD.

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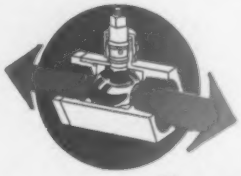
UNION PIPE, INC.

(AGENT OF OIL COUNTRY TUBULAR GOODS & LINE PIPE IN U.S.A.)
420 LEXINGTON AVENUE, NEW YORK 17, N.Y.

A Significant Announcement to the Refinery and Petrochemical Industries



jamesbury "Double-Seal"™ TYPE DZ FIRE*SAFE†™ BALL VALVES*

Available for application in a wide range of installations in the heart of the refinery processing areas and in petrochemical and natural gasoline processing services.

Proved in long-term pre-testing and in full scale processing installations, the Jamesbury "Double-Seal" FIRE SAFE Ball Valve brings the advantages of full flow, quarter-turn positive shut-off, low torque and no lubrication to "the heart of the process" in these industries.

Complete size range and materials data available on request.

Write for Jamesbury Refinery Brochure for further details.

JAMESBURY CORP.

92 New Street, Worcester, Mass.

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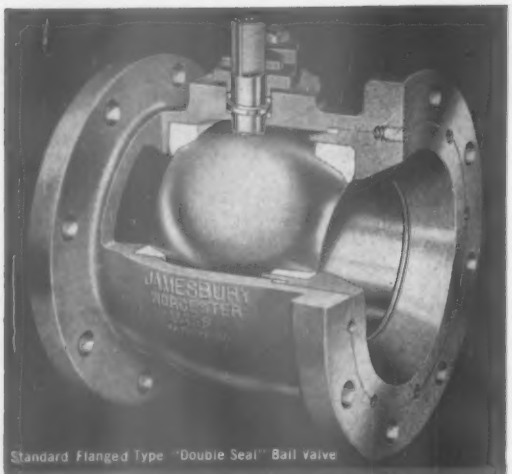
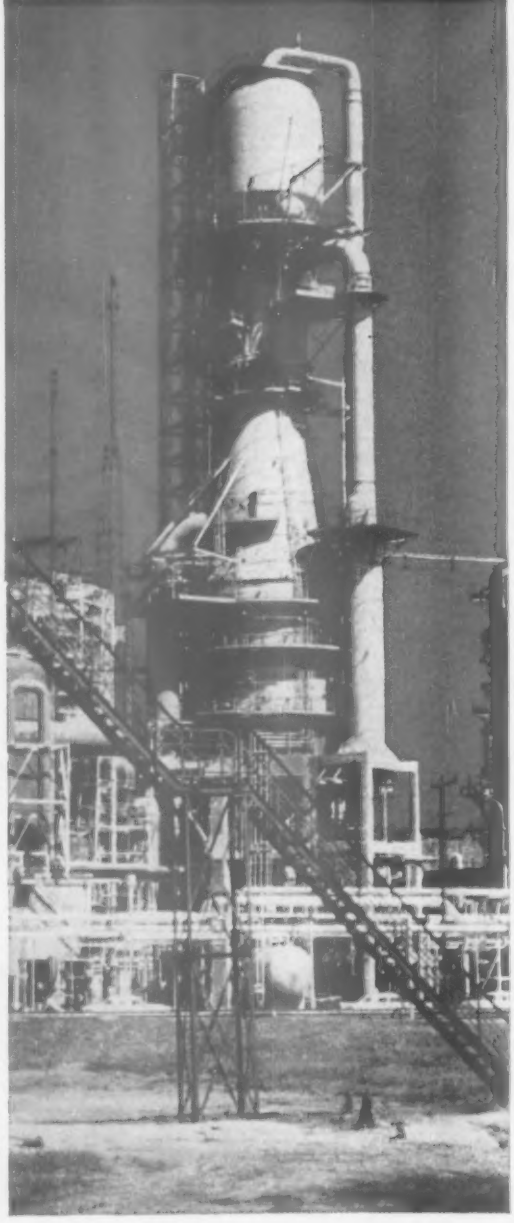


Standard Flanged Type "Double Seal" Ball Valve



321-O

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*PATENTED
†pat. app. for

Equipment Men Notes

Oil Well Supply Division names

. . . W. A. Weir to the post of vice president in charge of sales, and M. F. Hazel to executive vice president of the division of U. S. Steel Corp. Both men will locate at Oilwell's headquarters in Dallas.

W. A. Weir

M. F. Hazel

Since 1952 Weir has been serving as manager of the division's Canadian-area activities. He joined the concern in 1929 as a sales trainee at Florence, Colo. In that same year he was transferred to Calgary, Alta. In 1933 he went back to the U. S. where he served as manager of stores at Rodessa and Thibodaux, La. and at Kilgore, Tex. Before returning to Canada in 1945 as district manager, Weir spent 3 years at the Dallas headquarters in the merchandise department.

Hazel, who moves up from vice president in charge of sales, was employed by Oilwell in 1930 as an engineer at Oil City, Pa. In 1937 he was transferred to Odessa as district sales manager. In 1948 he went to Dallas as general manager of sales, and in 1951 was appointed director of engineering. Hazel became vice president of sales in 1955.

Jarvis Brown assumes duties

. . . as advertising and sales-promotion manager of Weatherford Oil Tool Co. His 27 years experience in various phases of the oil industry includes operation of his own production company. Since joining Weatherford in 1947, Brown has held positions as personnel training director, supervisor of manufacturing quality control, and manager of several district sales offices.

Dunwoody Pipe & Supply adds

. . . two to its sales staff. J. Marcus Powell has joined Dunwoody as a pipe sales representative in West Texas with home offices in Midland. Tubular-sales-engineer C. A. (Chic) Bulot will be based in Dallas, covering north and East Texas and the Shreveport area.

Powell formerly was with National Supply Co. for 39 years, holding field and district managerial posts in Louisiana and West Texas. Bulot has 30-years experience with National Supply. He has been engaged in tubular sales the past 17 years.

Go Jet Services, Inc. is formed

. . . in Tulsa as a new wireline-service company offering jet perforating, gamma/neutron logging, and allied oil-well services, according to Larry Drake, one of the founders.

Larry Drake

Service area of the $500,000 corporation will include Oklahoma, Kansas, and the Texas Panhandle.

Company officers include Drake, chairman of the board of directors; O. B. Avent, president; and B. D. Nation, secretary-treasurer, all of whom formerly worked for Welex, Inc.

R. H. Rainey is appointed

. . . assistant to Eastern Hemisphere Vice President C. M. Moore, Jr., of Geophysical Service, Inc., according to R. C. Dunlap, Jr., president of the exploration subsidiary of Texas Instruments, Inc. Rainey has been with GSI the past 14 years. Four and a half years of his geophysical experience was gained as a supervisor and later manager of GSI reflection, refraction, and gravity operations in the Far East.

In addition to his Far East experience, he has also worked as a seismic supervisor in Canada and West Texas. Rainey was made marketing manager in 1959. He will continue to headquarter in Dallas but will maintain liaison with operations in the Far East, Middle East, and Africa.

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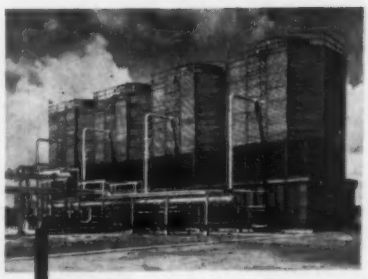

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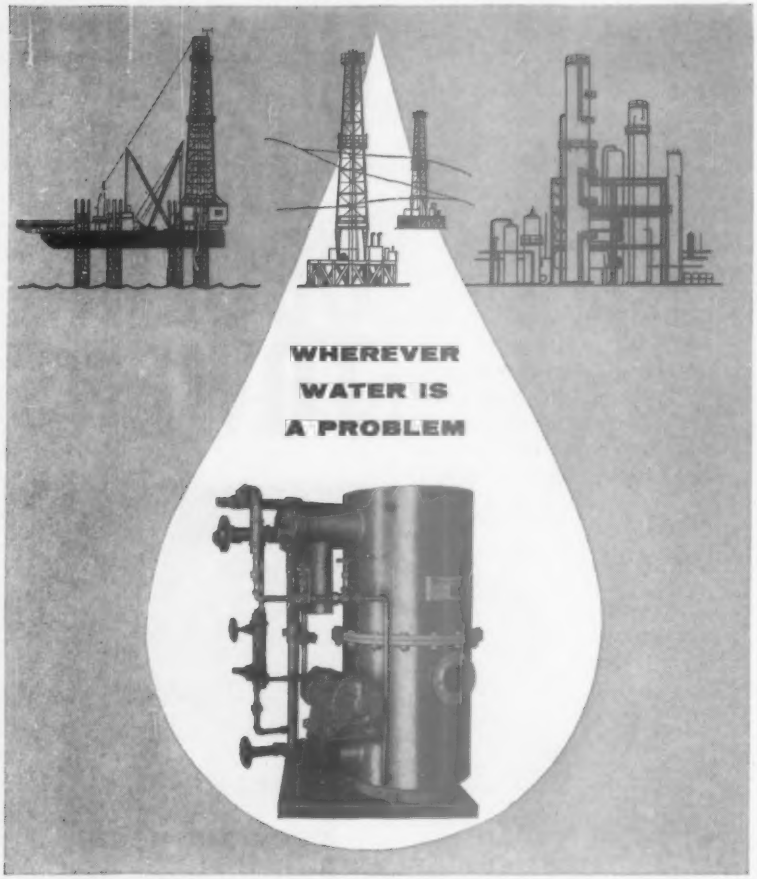

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Erwin A. Wendell is manager

E. A. Wendell

. . . of advertising and public relations for Link-Belt Co., with headquarters at the company's executive offices in Chicago, reports D. E. Davidson, vice president. The appointment follows the retirement of Bertram V. Jones, advertising manager for the past 10 years and a member of the advertising department since 1923.

Wendell joined the company's engineering department at the Pershing Road plant in Chicago in 1917. He entered the sales department in 1921, serving in the Chicago territory until 1937, when he was appointed manager of the St. Louis district office. In 1944 Wendell became manager of the Chicago district office, and 3 years later he was named sales manager for the Link-Belt Caldwell plant in Chicago.

He joined the executive sales division at the executive offices in 1953, engaging in market research and sales analysis. Wendell became assistant advertising manager last August.

Raybestos-Manhattan appoints

. . . S. R. Zimmerman, Jr. as executive vice president of the corporation. Zimmerman is a director and vice president of the corporation, general manager of the United States Asbestos—Grey-Rock Division at Manheim, Pa., in charge of operations of the Pacific Coast Division at Fullerton, Calif., and is director of Cassiar Asbestos Corp., Ltd., in Canada.

Infilco, Inc. stock is acquired

. . . by General American Transportation Corp., according to T. M. Thompson, president of General American Transportation, Chicago, and J. Shannon Gustafson, president of Infilco, Tucson, Ariz. Infilco will continue to operate under its present management in close

cooperation with Fuller Co., another subsidiary of General American.

Stewart E. Cartwright joins

. . . Southwest Barber, Ltd., Canadian subsidiary of Southwest Industries, Inc., of Houston, to serve as president. He will headquarter in Calgary. During the last 14 years Cartwright has worked in engineering design of petroleum-process units for Pan American Refining Corp., Power Specialty Co., and Delta Engineering Corp.

J. E. Himmelrich takes over

J. E. Himmelrich

. . . as sales manager for pipeline coatings of Pittsburgh Chemical Co.'s Protective Coatings Division. He was formerly based in New York City as regional sales manager of the division's eastern territory. Himmelrich served previously as division sales representative in Tulsa and, before that, in the Pittsburgh area. He joined the division in 1949.

Meanwhile, W. D. Moore has been named assistant to the sales manager for pipeline products in the division. He was formerly a division sales representative in Kansas City and, before that, in Tulsa.

Manufacturers group is formed

. . . to assist its member companies in improving efficiency of their operations and thereby giving better services to customers. The organization—Process Equipment Manufacturers Association—is headed by J. D. Hitch, Jr., director of Dorr Oliver, Inc., president; and Harlow Hardinge, president of Hardinge Co., vice president. R. P. Kite is executive secretary-treasurer.

The executive committee is composed of: Calvin A. King, president of Bird Machine Co.; P. H. Mulcahy, manager of Wemco Division, Western Machinery Co.; Harold M. Soars, president, Sprout, Waldron & Co.; A. L. Bolton, Jr., treasurer, John W. Bolton & Sons; A. J. Chubb, general manager, Raymond Division, Combustion Engineering, Inc.; H. J. Douglas, general manager, Pennsylvania Crusher Division, Bath Iron Works; H. I. Edwards, vice president, Pfaudler-Permutit, Inc.; Milton Spiegel, general manager, Chicago Pump Division, Food Machinery & Chemical Corp.; and E. C. Swift, president, Sharples Corp.

NOMAD OFFICERS ELECTED in Los Angeles at the chapter's annual business meeting held recently. Incoming and retiring officers, from left, front row, are: P. M. Bowen, Martin-Decker Corp. (treasurer 1960); C. C. Sutton, Oil Well Mfg. Co. (assistant secretary 1960); Charles M. King, Baker Oil Tools, Inc. (president 1961); Louis Q. Webber, Martin-Decker Corp. (treasurer 1961); Lee J. Laird, Ladish Pacific Division (sergeant-at-arms 1961); and John Cochran, Driltrol (assistant treasurer 1961). In the back row are Robert P. Gaylord, Wagner-Morehouse, Inc. (senior regent 1960); B. Bronzan, McCullough Tool Co. (deputy sergeant-at-arms 1960); Willard F. Goertz, Monarch Engineering Co. (deputy sergeant-at-arms 1961); Earl M. Daniels, Hydril Co. (regent 1960); Tom R. Ashe, Globe Oil Tools Co. (regent 1961); and Henry Pullman, Baker Oil Tools, Inc. (senior regent 1961).

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William Green named manager
. . . of the Mid-Continent Supply Co. store at Gainesville, Tex., after 4½ years as a field salesman at the company's Wichita Falls store. Green joined Mid-Continent at the Abilene store in 1950. He transferred to the Bowie store in 1951, and remained there for 4 years before moving to Wichita Falls.

Schlumberger shifts personnel
. . . in its Mid-Continent, western, and Texas-Louisiana locations. T. G. Evenson, sales engineer at Newcastle, Wyo., has been promoted to manager of that location, while W. M. Baker, field engineer general in Glendive, Mont., has been transferred to Billings as a sales engineer. F. W. Beazley, location manager in Pratt, Kans., has been transferred to the Kansas division in Wichita where he will serve as a senior sales engineer. L. F. Holdman, field engineer general at Mount Vernon, Ill., has been named sales engineer for that location.

In Louisiana, L. H. Reynolds has moved to the Louisiana Gulf Coast division in Lafayette as a senior sales engineer. He had previously been assigned to New Iberia. G. M. Lehnertz, senior sales engineer, has transferred from the north-central division to Tyler, Tex.

Sarnia Inspection Co. sets up

. . . a company in Pasadena, Tex., under the direction of Donald Thomas, vice president, to offer radiography inspection services. The office is located at 5217 Spencer Highway.

For refineries and other process plants, Sarnia will offer the "Sinco Tru Gauge" on-stream inspection service for measuring pipe wall thicknesses and tubes in heat-exchanger bundles. The office will also be available for radiographic determination of reasons for valve malfunction and liquid level on tower trays.

Welex, Inc. transfers
. . . its sales, operations, and administrative departments from Fort Worth to 1728 Old Spanish Trail in Houston. The move is part of the wireline service organization's transfer of headquarters to Houston. Headquartering at the new locale will be Turner Armstrong, Halliburton vice president and general manager of the Welex Division; W. E. White, sales manager; H. B. Lee, operations manager; R. E. Lowe, assistant manager of administration; and Jack Hickey, advertising and sales-promotion manager.

Marsh Instrument Co. appoints
. . . Don L. Warner as assistant sales manager. A Marsh employe for the past 10 years, Warner was previously district manager of the Philadelphia office.

Taking over Warner's Philadelphia job is James Kelly, a 19-year company employe who moves from his assignment as midwestern district manager. Robert Ely, succeeding Kelly, had been a midwestern district sales representative.

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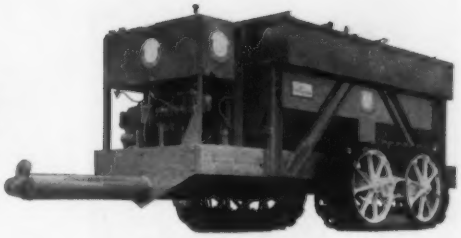

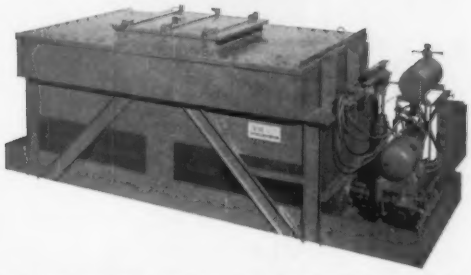

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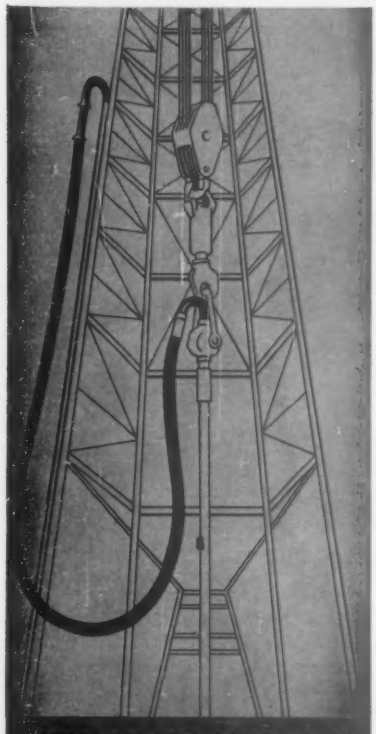

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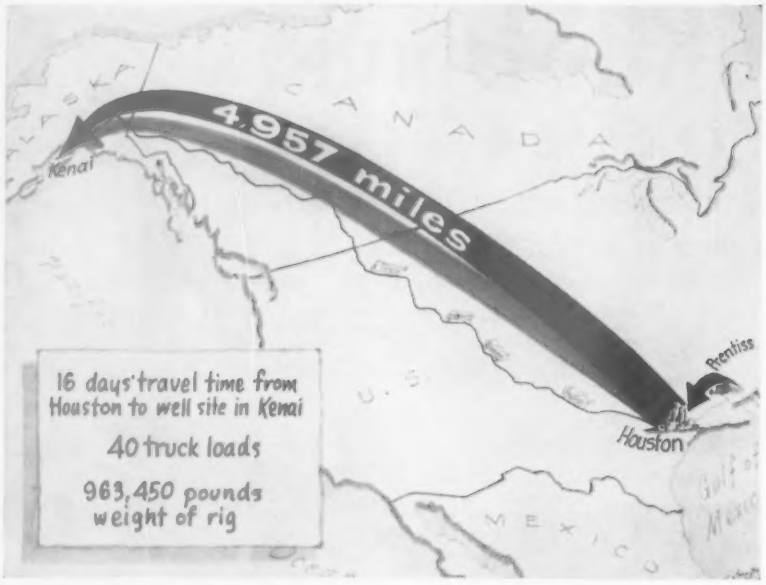


World's longest overland rig haul done "Texas style"

IT'S A LONG, HARD TRIP from Houston to the Kenai Peninsula of Alaska by road. The total route mileage is 4,957. Yet a Reading & Bates National 110 rig made the trip by truck in 16 days travel time.

This is quite a feat and more so when you add the additional miles required to get the unit to the Houston staging center. Parts of the drilling unit came from Levelland, Tex., while most other components were hauled to the starting point from Prentiss, Miss. Altogether, nearly 1,000 more trucking miles were involved before the rig left Houston.

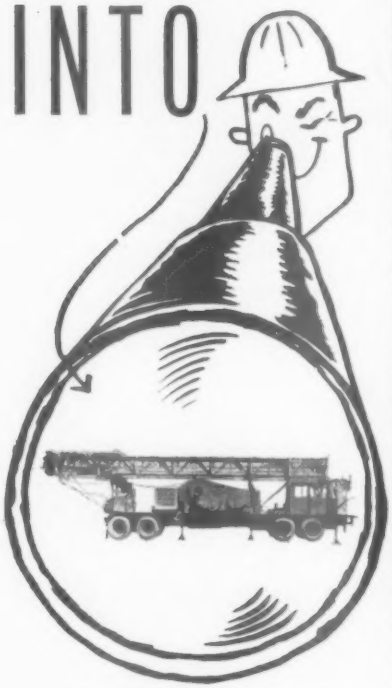
Why was the rig trucked? Figuring both methods of transportation, water and land, the cost is about the same. Considering loading, unloading, and travel time, the land route is much faster. The time factor was critical in this case.

The job was accomplished through the joint efforts of Hill & Hill Truck Line, Inc., Houston, and Reading & Bates, Inc., Tulsa. The trucking firm preplanned for all contingencies that might arise during the trip.

Loads were designed for the terrain, weather, and state load laws. Altogether, the shipment passed through six states and four provinces. Problems associated with nonconformity of rules and regulations regarding overheight, overwidth, and overweight of the various areas presented minor difficulties which were readily overcome. For example, Oklahoma and Colorado prohibit Saturday afternoon and Sunday travel with permit loads. The laws of Alberta prohibit the transportation of international freight in excess of 72,000 lb. gross vehicle weight. It was therefore necessary to unload a portion of the trucks and put the overage equipment on flat cars for shipment to Dawson Creek, British Columbia. Three days travel time was lost while empty trucks drove 750 miles to meet the freight train.

The 40 trucks that were used in the haul were assembled in Houston. The convoy system was used and the group was divided into three sections. The first section left Houston on September 16. The sections were spaced approximately 50 miles apart and within 48 hours from the time the first truck departed, the entire column was on its way. Spacing between the trucks in each section was 700 ft. so that ample passing room was provided

WORTH LOOKING INTO



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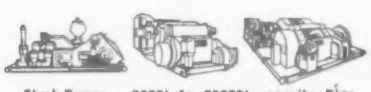


Slush Pumps 3000' to 25000' capacity Rigs

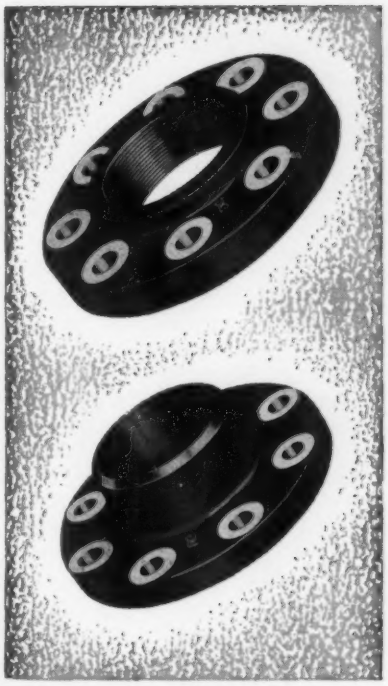
for the general traffic. As a consequence, there were no accidents enroute.

H. Ormston, president of Hill & Hill, traveled with the caravan and made some personal observations along the way. He noted that the highway from Edmonton to Dawson Creek, B. C., was excellent.

Most of the trucks made Milepost 300 and Fort Nelson the first day out of Dawson Creek. The city of Fort Nelson is reminiscent of the bustling oil boom towns of the 20's, where food was scarce and available beds in somewhat short supply. During the next day the convoy reached the settlement of Steamboat Mountain at Milepost 351. Dust and a preponderance of flat tires partially disorganized the efficiency of the convoy system. At Milepost 392, the summit of Steamboat Mountain was negotiated and when Milepost 632 was reached south of Watson Lake, a change in plans was deemed necessary. The operation was hectic, with burned-out wheel bearings and generators, flat tires, low bridges which required extra unloading and reloading, icy approaches to bridges, high winds, some ice and snow, stranded tourists, jacknifed house trailers, and trucks spinning in and out of ditches on hills. But at that point all plans were cancelled and the mode of approach was changed from convoy to Texas style—every man for himself.

Things began to look up and Milepost 1,202 at Beaver Creek Lodge was reached without major event. The most hazardous part of the trip was navigating Sheephead Mountain, 60 miles northeast of Palmer, Alaska. High winds, snow, and icy highways forced the truck carrying the 66,000-lb. draw works to wait 2 days at the summit before there was enough visibility in the blowing snow to attempt the descent down the 7 miles of icy hairpin turns. Despite precautions all the trucks gained speed and it was a stimulating challenge to keep the tractors ahead of the trailers and stay on the road.

The trip ended on October 1 for the first group of trucks. The men of Hill & Hill did a creditable job and with an assist from the Reading & Bates drilling crews the rig was ready to work shortly after arrival.



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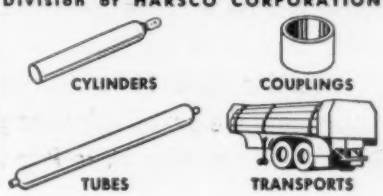

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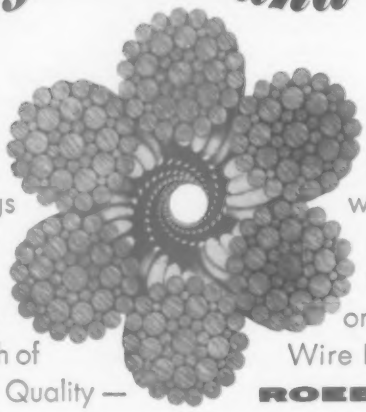

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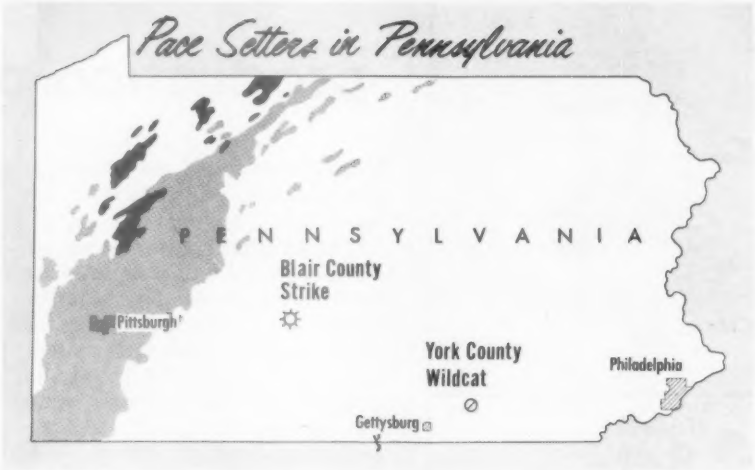

TWO REMOTE WILDCATS hold the attention of Pennsylvania explorers. One, in Blair County, has been finished as a gas discovery. The other, in York County, lies far removed from previous producers. Both will have important bearing on future exploration in the Keystone State.

Pennsylvania gas hunters look toward the East

BY FRANK J. GARDNER

INTERESTING THINGS are happening in Pennsylvania. This oldest American oil theater is the scene of renewed exploration effort by at least a dozen major oil companies and many independents. The chief target, understandably, is gas. A ready market at a good price waits at every christmas tree. Of course, a good Pennsylvania oil well is not to be sniffed at, but like many other parts of the country, the Appalachians are occupying more and more of the thoughts of the gas hunter.

An eastern outpost . . . A most important discovery recently accentuated the trend when Phillips Petroleum Co. finished its Pennsylvania Tract 26 A-1 in Greenfield Township, Blair County, for 1,200 M.c.f.d. from Devonian Oriskany pay at 6,858 ft. This new field lies 22 miles farther east than any previous Pennsylvania production. It lies on one of the many en echelon folds which traverse the central part of the state in a southwest-northeast direction, and only 3 miles northwest of the Oriskany outcrop. It's hard to conceive what wide vistas of exploration have been laid bare by this discovery.

And the Blair County well is only one of many important deep gas strikes which have dotted the Pennsylvania landscape in recent months (see OGJ, Feb. 6, 1961, p. 186).

And an oil man's vision . . . A current rotary-drilling operation in southeastern Pennsylvania is an even greater stimulant to the explorer's imagination. This one, in York County, is only about 100 miles west of Philadelphia, and there's an interesting story behind it.

It seems that this extraordinary wildcat is the climax to some discovery thinking on the part of a retired civil engineer and oil man, Henry F. Thomas. When he went the retirement route, he chose his boyhood home in southeastern Pennsylvania as the best place to forget it all. But oil is a fever in the blood, and Thomas, in his meanderings through York County, stumbled across numerous oil seeps in the surface rocks.

Dusting off his lease forms, Thomas went to work. He signed up 60,000 acres as agent for Donelson Co., of Hanover, Pa. The leases run for 10 years, and Donelson plans to drill three wildcats. The first is now drilling below 6,040 ft.; known as the 1 Harry Leib, it lies in Dover Township, Hanover 15' Quadrangle, and its target is the Paleozoics at about 7,000 ft.

The 1 Leib spudded in Triassics, which are believed to be nearly 7,000 ft. thick in this area; this leaves much to be learned about the actual presence or thickness of the Paleozoic section here. According to geologists in the state, the well might find formations as young as the Martinsburg-Upper Ordovician, or it might go right into Cambrian rocks. Donelson set 412 ft. of 13-in. casing as surface protection, and reports are that the contractor, Sam Jack, is having formation-water troubles at the well. Location was staked on a surface anticline, but what lies beneath is anybody's guess, according to geological observers.

There have been other wells in the York County area. In 1959, a wildcat known as Miller, Wrightstone, & Shearer 1 Miller was drilled to the northwest of the 1 Leib in Monogahan Township. It drilled 1,000 ft. of diabase and was shut down in the Triassic at 2,700 ft.; here, a 10,000-ft. thickness has been estimated for the Triassic.

Might change some concepts . . . Success in York County could completely revise our thinking in regard to the eastern half of Pennsylvania. Success at the Blair County well has expanded our perspective in the West. In short, we've got a lot to learn about all of Pennsylvania, where the whole thing started in 1859.

Four Corners production of

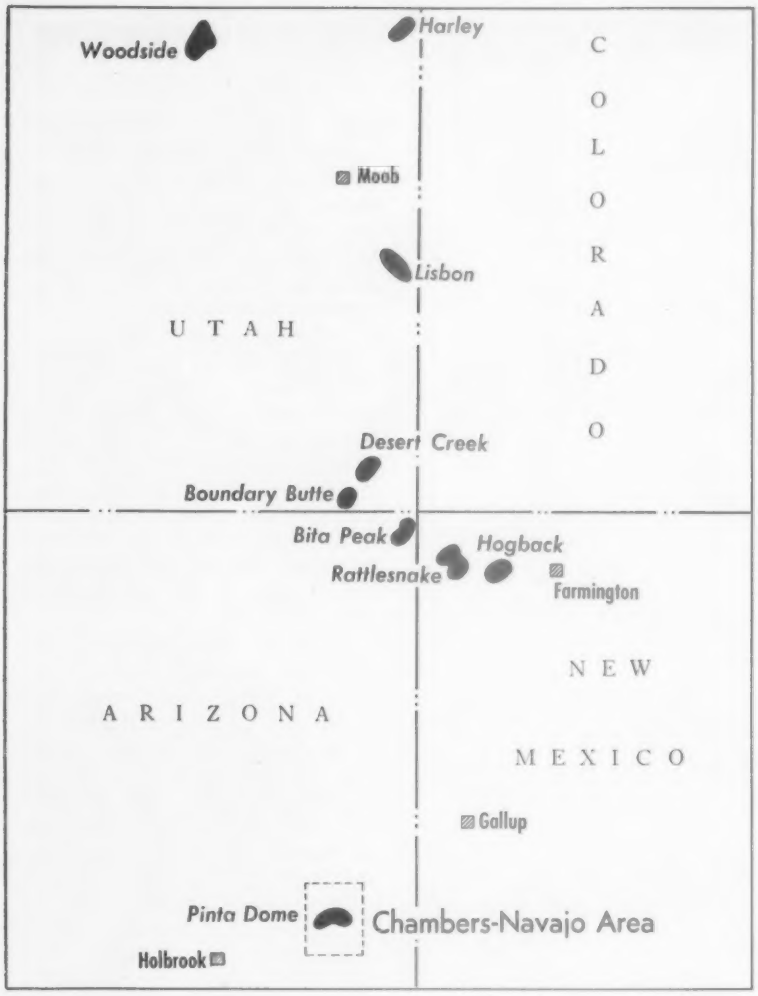

FIG. 1

Helium accumulations in the Four Corners area are shown above. For some reason, this is one of the most prolific areas for finding rare gas.

HELIUM is among the rarest and most valuable commodities of nature.

The existence of significant accumulations of this rare gas has been known in the Four Corners region for several decades. Some of the more commonly known reservoirs, Rattlesnake and Hogback fields of New Mexico, Model dome of Colorado, Harley dome of Utah, and Pinta dome of Arizona, have particularly rich contents of this inert gas (Fig. 1).

Pinta dome, in northeastern Arizona, is the richest. It has a helium content ranging between 8 and 9%. Of these and other scattered accumulations, including Woodside dome, Boundary Butte, and Desert Creek fields in Utah, only the helium gases at Rattlesnake and Hogback fields and Model dome have ever been processed and marketed.

During 1960, the Navajo-Chambers area yielded additional discoveries of 8 to 9% helium-bearing gas on the Navajo Springs structure and nearly 10% helium-bearing gas on the Salt Springs structure. Both of these discoveries are in the immediate vicinity of Pinta dome. Discovery of almost 6% helium-bearing gas was made in the Bita Peak area of extreme northeastern Arizona and 2% helium was reported in the Lisbon area of Utah. This noble gas has no apparent affinity for any particular geologic age. Its occurrence has been noted in the various reservoirs cited above and others, in rocks ranging from the Upper Cretaceous through Devonian.

Reservoirs of the Navajo-Chambers area of Apache County, Arizona, with 8 to 10% helium content are the richest known in the free world. The accumulation of helium in the Navajo-Chambers area is not only significant because of its extremely high percentage, but also because it represents, in our opinion, one of the largest accumulations

About the authors . . .

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James W. Dean was graduated from the University of Illinois in 1948 with a BS degree in geology. He also did graduate work at the University of Oklahoma. Until 1953 he worked for C. E. Brehm Drilling & Producing Co., and the Peter Fox Brewing Co. in the Mid-Continent area. Until 1957 he was a consultant in the Illinois basin area. Since 1957 he has been associated with Eastern Petroleum Co., is vice president of that company, and heads its Rocky Mountain Division in Denver.

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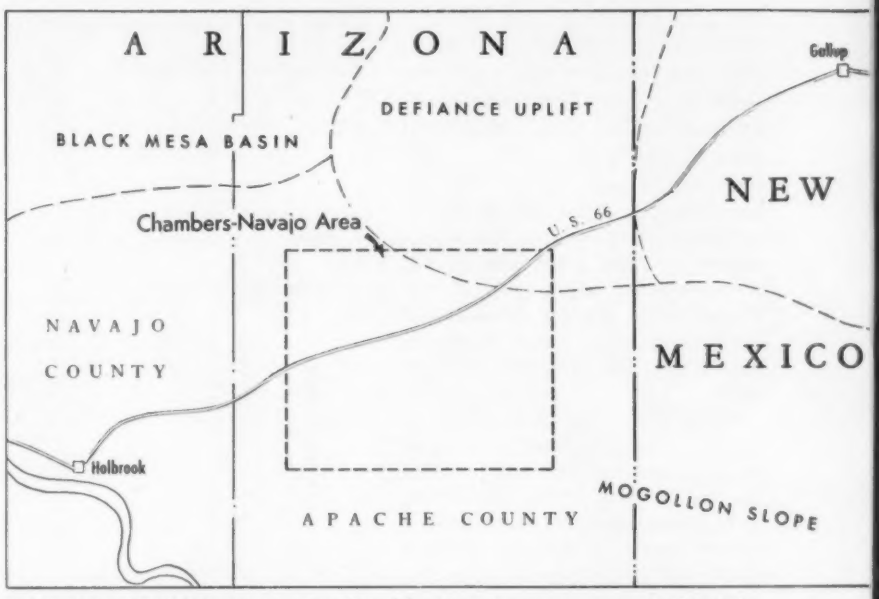
keeps lead in helium gas

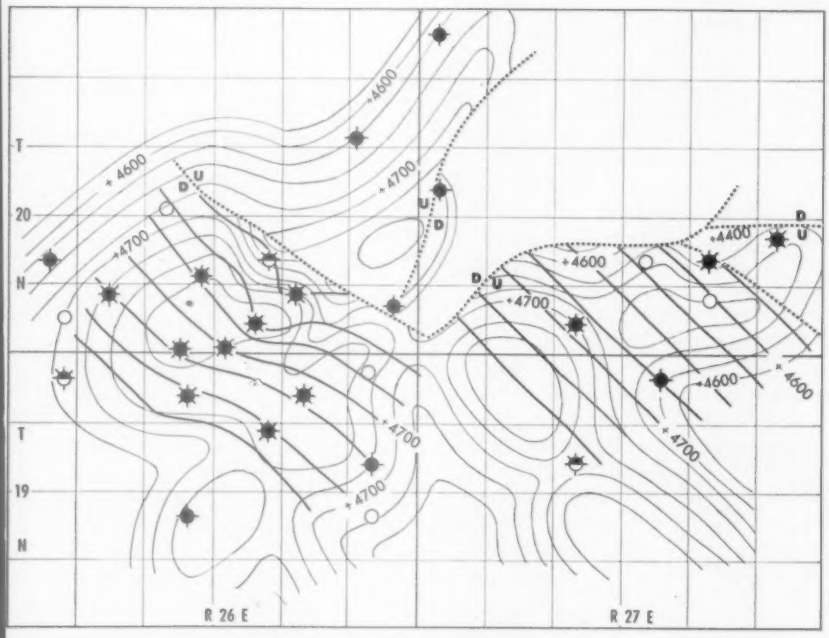
BY JAMES W. DEAN AND R. E. LAUTH

of reserves for a given area of development. Also, it is the only area in the history of the industry that has seen sustained exploration and development for helium gas alone. The area of immediate interest can best be located by its proximity to Petrified Forest National Monument and Painted Desert. It is crossed by Highway 66, midway between Gallup, N. M., and Holbrook, Ariz. (Fig. 2). The area completely surrounds the communities of Navajo and Chambers.

In 1950, the Kipling Petroleum Co. drilled the discovery well on the Pinta dome at a location recommended by Silas Brown, a Phoenix consultant. The well was in 34-20n-26e. This test encountered helium-bearing noninflammable gas in the Chinle formation and a relatively large flow in the Coconino sandstone at 1,030 ft. The well flowed unrestricted for about 8 weeks.[1] Four weeks after completion this well was reported to have had a potential of 24 M.M.c.f.d. and a casing-head pressure of 98 psi. A second producing well was later drilled by this firm. These wells and numerous leases were later acquired by Kerr-McGee Oil Industries, Inc. That company has, since 1956, drilled six field tests, with four being productive. In 1959, Eastern Petroleum Co. drilled four tests in the field. Three were productive from the Coconino reservoir and one resulted in a noncommercial completion in the Chinle. During 1960, Eastern Petroleum drilled five wildcat wells in the general area. Two were joint ventures with Crest Oil Co. and one of these resulted in a Coconino gas discovery on the Navajo Springs structure, 33-20n-27e.



GEOLOGIC PROVINCES affecting the Chambers-Navajo area are seen in this index map. It is traversed by U. S. Highway 66 and lies just east of the Petrified Forest National Monument nearly midway between the cities of Holbrook, Ariz., and Gallup, N. M. Fig. 2.



STRUCTURE at Pinta Dome is apparent from the surface with about 75 ft. of closure. There are two trends of folding associated with a scissors fault. Major Paleozoic folding has northwest alignment (heavy lines) while secondary post-Paleozoic folding is more northeast-southwest (light lines). Fig. 3.

Our development drilling on the Navajo Springs feature has resulted in one additional producer and one dry test. The most recent test drilled in this area at 25-20n-27e by Crest Oil and Eastern Petroleum resulted in the discovery of a third producing reservoir related to the Salt Springs structure immediately east of that well. Current locations proposed are in 1-19n-26e by Eastern Petroleum, and in Section 13 of that township, by Linehan & Stoltenberg; in Sections 21 and 31, of 20n-26e, also by Linehan & Stoltenberg; and in Section 26 of the same township, by Kerr-McGee; and in Sections 27 and 35 of 20n-27e by Crest Oil and Eastern Petroleum.

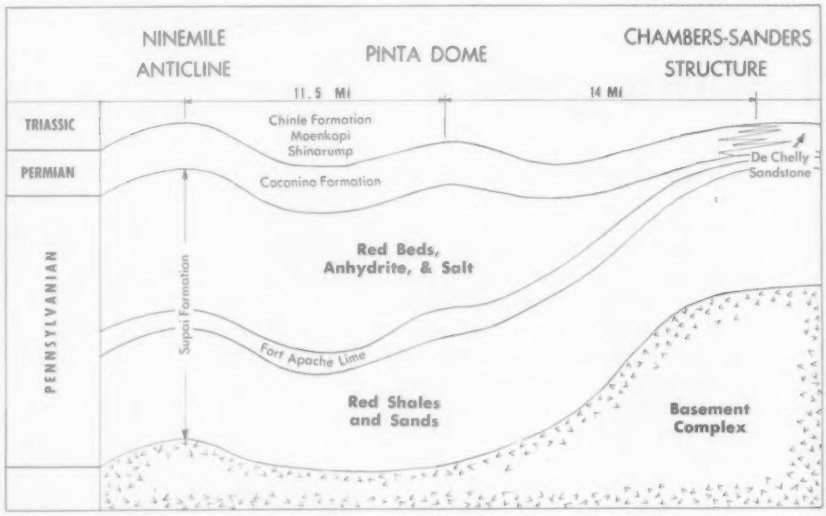
Regionally, the Navajo-Chambers area is on the Mogollon slope, which bounds Black Mesa basin on the

south, and forms a wide southern border of the Colorado Plateau. The area occupies an immediate position to the westward-dipping Defiance uplift. There are several lines of folding in the Black Mesa basin and Mogollon slope. The major folding of Paleozoic age has a northwest alignment. Secondary alignments have a northeast trend, a north-south trend, and a still weaker trend which parallels the edge of the basin. These secondary alignments are post-Paleozoic in age.[2]

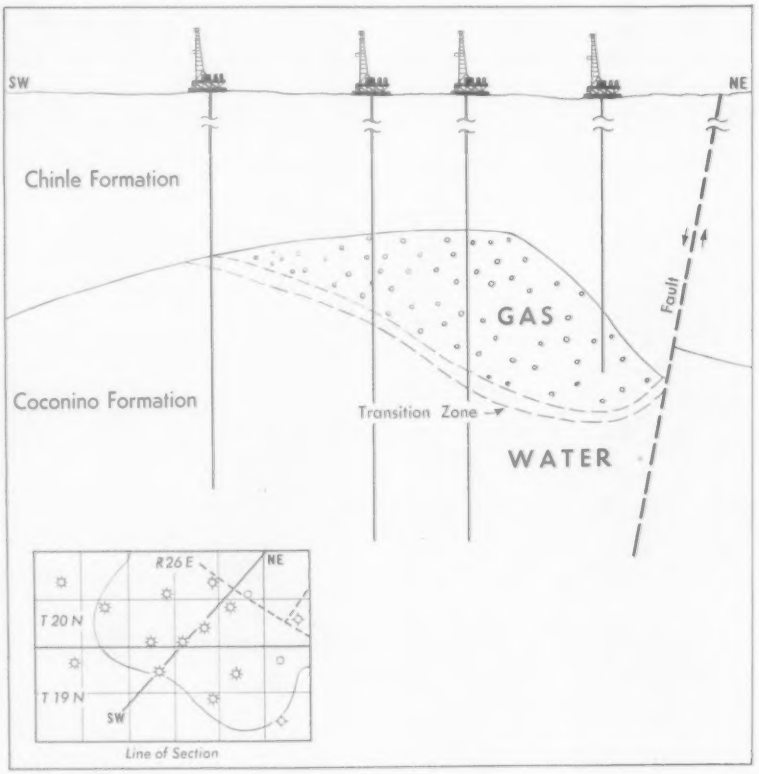
Pinta dome was recognized in early reconnaissance by Brown and the structure was mapped in detail by him in June 1948. The dome has approximately 75 ft. of surface closure and is principally confined to the southern portion of 20n-26e, and the extreme northern portion of 19n-26e (Fig. 3). Pinta dome is at the culmination of two predominate trends of folding, the axes of which are principally aligned northeast-southwest and northwest-southeast. Along the former alignment, the North Pinta nose is separated from the dome proper by a scissors type of crossfault. The fault trace is evident at the surface and is believed to increase from 25 ft. displacement at the northwest extremity to possibly 200 ft. at its juncture with the Puerco fault near the Kerr-McGee 5 State in 36-20n-26e. The fault is upthrown on the north. The North Pinta anticlinal nose is part of a dominant subsurface ridge that continues northeast and connects with the Chambers-Sanders structure. The anticlinal nose is terminated sharply along its east flank by the Puerco fault. The fault has over 200 ft. of displacement and is downthrown on the east. The Crest Oil 1 Santa Fe, in 19-20n-27e bottomed in the Coconino on the downthrown side of the fault. Both the Puerco fault and the Pinta dome crossfault are presumed to be high-angle.

The Navajo Springs structure forms the southeast limb to the major northwest-southeast fold trend to the Pinta culmination. The area of influence of this feature is bounded by the Navajo Springs and Kirby faults, downthrown to the north. Displacement approximates 200 ft. Bifurcation of the Navajo Springs fault occurs in the eastern

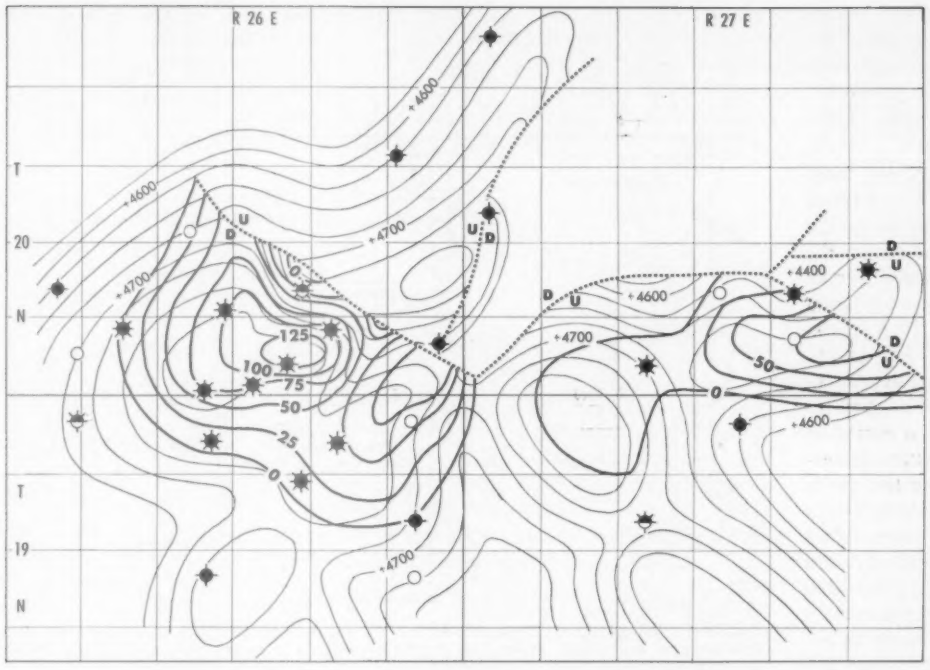
"The fault has over 200 ft. of displacement and is downthrown on the east."



STRATIGRAPHIC sequence in cross-section across the Pinta Dome shows that there is only about 3,500 ft. of sedimentary section above the basement complex. The Chinle formation is encountered at and immediately below the surface. Note the facies change that occurs between Pinta Dome and the Chambers-Sanders structure in the Coconino equivalent as the shallower section to the northeast grades laterally into the DeChelly sandstone. Fig. 4.



CROSS-SECTION of Pinta Dome proper displays apparent tilt in the gas-water contact. Stratigraphic irregularity may be in part responsible for the "S"-shaped interface. Prolonged unrestricted gas flow of the discovery well may have induced abnormal water encroachment. Fig. 5.



ISOPACHOUS MAP of the Coconino gas pay is superimposed on structure contours. Maximum thickness is 134 ft. near the Kerr-McGee 2 State in 34-20n-26e. Fig. 6.

part of 20n-27e. The major continuing element traversing generally east-west across 20n-28e has been termed the Salt Springs fault. Undoubtedly, many other faults exist in the area that have not yet been recognized and mapped.

Where Tertiary beds are absent, surface exposures in the general area are the lenticular Sonsela-sandstones of the Pinta Desert member of the Chinle formation. The total sedimentary rock section, above the basement complex is approximately 3,500 ft. (Fig. 4). The Triassic sequence, resting above the Coconino, includes the Chinle, Shinarump, and Moenkopi formations. At Pinta, the Chinle formation, encountered at and immediately below the surface, is comprised of 670 ft. of predominately red, gray, and green shales, siltstones, and minor sandstones at depth. The Chinle formation includes in its lower portion a conglomeritic section approximately 64-ft. thick which has yielded a secondary helium-producing interval in the area. This interval is present in the Kerr-McGee 1 State in Section 34, where it had a natural gage of 500 M.c.f.d. and a helium content that averaged 7.4%.

The Shinarump, below the Chinle, is chiefly sandstone and conglomerate with interbedded mudstones and siltstones. The sequence averages 35 to 60 ft. thick in the area. The subjacent Moenkopi is approximately 125-ft. thick. Below the Moenkopi is the Permian Coconino sandstone. It is massive, light gray to buff, and contains much cross-bedding. Good porosity and permeability is evident throughout the section. Gross thickness of this formation attains 500 ft. The upper portion of the Coconino is an important helium-bearing sandstone in the area. The sandstone is extensively fractured and exhibits very little cementing. Underlying the Coconino is the Pennsylvanian Supai formation.

The staff of Eastern Petroleum Co. believes that other gas fields exist within and beyond the area discussed here. They will be the prize for those who develop aggressive and imaginative exploration thinking and have the willingness to gamble. The abandonment of a lease block, because a dry hole was drilled on top of the structure, could cost a company millions of dollars if the potentially productive area lay undetected far downdip.

Pinta field now has 10 completed producing wells in the Coconino reservoir. Navajo Springs field has had two wells completed in the Coconino. A pronounced tilt of the gas-water contact, within the structures, slopes to the northeast at an approximate rate of 59 ft. per mile. The tilt is maintained by northeast water movement within the reservoir.

It is interesting to note that the Crest Oil-Eastern Petroleum producer in 25-20n-27e, resting on the downthrown side of the Kirby fault produces gas 200 ft. below the established field tilt. Structural position of the well combined with other factors, such as bottom-hole pressures, helium percentage content, and high volume, indicates that the well is producing from a portion of a new and much larger reservoir related to the Salt Springs structure.

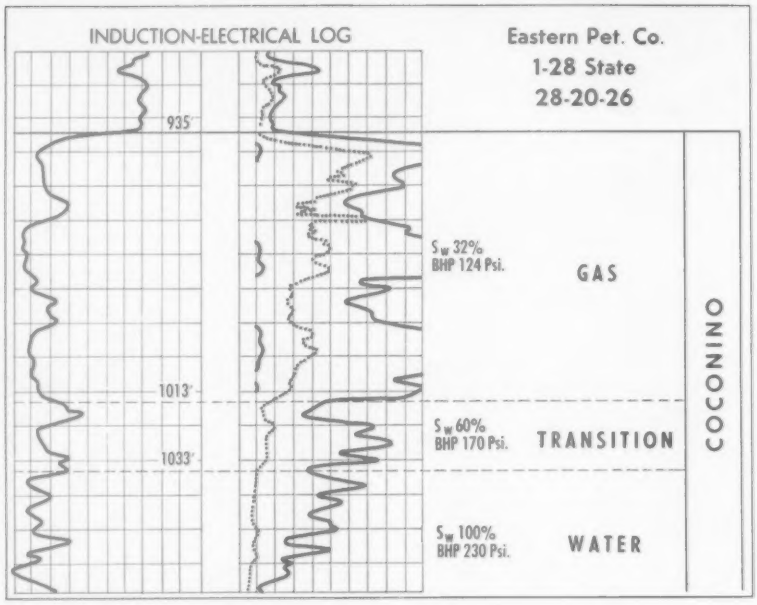
At Pinta, there is a pronounced flexure of both updip and downdip contours of the gas-water contact toward the general direction of 34-20n-26e. There is a twofold explanation of the phenomenon. The prolonged period of unrestricted flow by the discovery well contributed to a lowering of pressure in this area. This also may have accelerated water movement within the reservoir and may have contributed to the general S-shaped gas-water interface. This may be more clearly noted in a cross-section of the field (Fig. 5). The S-shaped gas-water interface, however, is probably created and maintained by the partial block or restriction of the upper portion of the Coconino formation by the gas column. A lesser gradient, therefore, exists at the upper and lower ends of the tilted reser-

voir and a larger gradient occurs opposite the area of greatest restriction. This creates a greater-than-average tilt of the gas-water contact in the central part of the field.

Maximum thickness of the Pinta field occurs around the Kerr-McGee 2 State in Section 34 and totals 134 ft. (Fig. 6). At Navajo Springs, the maximum gas column drilled to date occurs in the Crest-Eastern 5 Santa Fe in Section 26 and is 27 ft. thick. It may be as much as 75 ft. at undrilled locations. The greater thickness at Pinta is primarily attributable to the greater critical northeast dip present on that structure. Reservoir characteristics of the two fields are strikingly similar. For this reason, comments on gas composition and helium content, porosity and permeability data, and formation pressures will not be separated by fields. Producing capabilities of individual wells range from 100 M.c.f.d. to 10,000 M.c.f.d. with an average wellhead pressure of 99 psi. The production potential of each well is directly related to total thickness of gas column encountered, existing fractures, and formation damage incurred during drilling operations.

An E.S. induction log of the Eastern Petroleum 1-28 State well will serve to display typical curve characteristics opposite the various gas, gas-water and water-bearing zones (Fig. 7). A transition zone occurs at the base of the gas column and above the true water-bearing portion of the Coconino. While present in all wells of the two fields, the interval varies from 6 to 21 ft. in thickness at Pinta and reaches 46 ft. in one well in the Navajo Springs field. Recognition of this zone can be important in reserve calculations. A drill-stem test of this interval in the Salt Springs discovery revealed a surprisingly high ratio of gas flow per barrel of water recovered. Formation recovery by diamond coring and severe lost-circulation zones reveal that the reservoirs are highly fractured. The Coconino has been diamond-cored extensively in the general area. Permeabilities of the pay section range from 550 md. to 4 md. with a field average of 100 md.

Porosities range from 10 to 25% with a field average of 16%. Water



ELECTRIC-LOG section shows the effect of the transition zone between the gas column and the water drive. The transition zone varies in thickness from 6 to 21 ft. at Pinta Dome, and it is evident in all wells in the field. Fig. 7.

saturations average 32% and have been verified by irreducible water-saturation analysis. An average 124-psi. pressure is normally recorded in the gas-pay section. This low pressure invariably invites comment from geologists and engineers alike. Dobbin reports that wells at Model dome produced 1-2 M.M.c.f. with formation pressures averaging 12 psi.[3] Projected exploration by Eastern Petroleum Co. includes reservoir areas with potential pressures as low as 30 psi. Proved area reserves are currently calculated to approach 1.5 billion cubic feet of helium, net. Continued eastward development from the Salt Springs discovery may increase the reserve picture substantially in the immediate future. Typical gas composition of the two fields is reflected in an analysis by the Bureau of Mines of samples taken from Eastern Petroleum 1-28 State well:

	Per cent
Nitrogen	89.9
Helium	8.6
CO_2	0.8
Argon	0.6
Methane	0.1

The origin of such large amounts of this chemically inert gas is still a problem. The fact that helium is given off in the disintegration of such radioactive elements as uranium, radium, and thorium has led to the belief that radioactivity is the original source of helium. Most helium probably originated from radioactive disintegration in the rocks not far beneath or above the formations in which helium-bearing gas occurs in the sediments.[4] Proximity of volcanics and igneous intrusions appear to have a definite significance to the area of particularly rich accumulations.

Approximately 1 M.M.c.f. of helium is extracted daily by the federal Government at the Keyes, Okla., plant from hydrocarbon gases containing less than 2% helium. Keyes is the newest and most efficient helium extraction facility operated by the Government. The unit cost is $8.57 per M.c.f.[5] Sales by the Bureau of Mines is on a double standard. Government agencies purchase at a price of $15.50 per M.c.f. and limited sales are made to private industry at a base price of $19 per M.c.f., plus a $2 cylinder charge. By provision of the 1960 Helium Act, it is well to assume that the reserves of the Navajo-Chambers area may best seek a market outlet to private industry. The current cost index to private industry may serve for purposes of evaluation. Based on the above, the current gross value of existing reserves of the area approximates 38 million dollars, with a potential return in excess of

20 million dollars after deduction of extraction costs. The latter makes no allowance for exploration and development costs. The potential dollar value growth of this commodity is quickly recognized if there is assigned an end product value of $40 per M.c.f., which is currently projected by the federal Government as a future base price.

A comprehensive discussion of the properties and uses of helium is a subject of its own. Briefly, helium is colorless, odorless and next to hydrogen, the lightest element known. At liquefaction (−450° F.), it is the coldest and most mobile fluid known. This noble gas transmits sound at a higher velocity than any other, has a lower solubility in water and other liquids, and a lower refractive index than any gas known.

Use of helium in the field of lighter-than-air travel, medicine, and as a tracer gas in petroleum reservoirs, is well known. Its application involving millions of cubic feet as a gaseous shield in the welding of magnesium, aluminum, and titanium, and in degassing molten metals is less recognized. Gas chromotography uses helium as a carrier gas, and is expected to create a tremendous market demand during the next few years. Helium is finding an increased use in the atomic-energy field as a leak detector and as a circulating medium in gas-cooled reactors. The gas has an unusually high heat capacity and is immune to atomic particles. Helium is filling an ever-increasing need as a critical defense item in the missile program. As the propellant and liquid oxygen are consumed in the rocket engine, helium, under high pressure, expands to take their place, producing strength and rigidity to the entire missile.

Of all of helium's new uses, however, none compares in potential with the new world opened up by the science of cryogenics—the study of the behavior of materials under conditions of extreme cold, near absolute zero. If lead is immersed in a bath of liquid helium, it becomes a superconductor. Once a current is passed through the lead at this temperature, it will continue to flow through the metal indefinitely.[6] This field is expected to have tremendous growth and will place a heavy demand on the future supply of helium. The manifold uses of this inert gas stretch into an endless list. Helium's many extreme qualities provide it with a versatility that is unmatched by any other "new" materials of this century.

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Arkoma adds significant gas discovery well

Mobil Oil Co. announced completion of an important discovery gas well in Arkoma basin about 3½ miles south of the West Kinta field in Haskell County, southeastern Oklahoma. The well, called Mobil 1 Quinton unit, was spudded on November 15, 1960.

E. V. Watts, vice president, Denver exploration and producing division, said, "This discovery represents some of the best-developed reservoir rock yet seen in the basin. Our Oklahoma City exploration district expects to drill subsequent development wells both east and west of the Quinton on its substantial holdings along that particular geological structure."

The Quinton well was dually completed from the Spiro and Cromwell sands of the lower Pennsylvanian age formation. Mobil owns a 73% working interest in the well which was air-drilled to better test prospective reservoirs and in an effort to reduce costs.

The Spiro sand was completed at 1,303 psi. shut-in tubing pressure with 7,450 M.c.f.d. calculated open flow. Perforations in the sand were made at 5,862 to 5,920 ft. The Cromwell sand showed 1,336 psi. shut-in tubing pressure, with 3,680 M.c.f.d. calculated open flow.

Mobil also announced that it has indications of another significant gas discovery at the Mobil 1 Mattie E. Horton wildcat in Custer County, West Central Oklahoma. Tests are currently under way there in the Oswego sands of Pennsylvanian age and in the Meramec formation of Mississippian age.

Panhandle's Ellis Ranch field moved southward in Texas

Ellis Ranch field, east-central Ochiltree County, Texas Panhandle, gained two long extension finds.

Shamrock Oil & Gas Corp. completed 1 Keith McLain for 2,600 M.c.f.d. through Cleveland Pennsylvanian sand at 6,882-98 ft. and 1,400 M.c.f.d. through Morrow perforations at 8,964-73 ft. Location is 11 miles southeast of Perryton, ¾ mile southwest of depleted Novi production at Dude Wilson field. Location is in Section 657, Block 43, H&GN Survey.

Shamrock also finaled 1 L. H. Littau flowing 1,580 M.c.f.d. from perforations at 6,940-92 ft. This extension lies 9 miles southeast of Perryton in Section 665, Block 43, H&TC Survey.

Remote New Mexico wildcat taps Morrow gas pay

A remote wildcat in Eddy County, Southeast New Mexico, promises gas production from the Morrow Pennsylvanian. Important discovery is Honolulu Oil Corp. 1 McKittrick Canyon unit, 6 miles southwest of Carlsbad in 25-22s-25e.

The well flowed 8,500 M.c.f.d. during drill-stem test at 11,193-11,257 ft. in the Morrow. There is no close production to the indicated discovery.

West Texas. Production tests are going at an important Ellenburger Cambro-Ordovician discovery in northeastern Terrell County, 10 miles south of Sheffield. The well is Texas Crude Oil Co. and Superior Oil Co. 1-22 Allison, 10 miles north of big Brown-Bassett field.

The well flowed 19 bbl. of fluid in 1 hour through 15/64-in. choke. Testing is through perforations at 12,435-76 ft.

More Ellenburger gas flows at Pecos County wildcat

One of the most important wildcat events of the early part of 1961 is taking place in Pecos County, far West Texas. Southern Minerals Corp. and General Crude Oil Co. 1-A Jasper CSL, 30 miles southeast of Fort Stockton, continues to uncover more gas-condensate pay in the Ellenburger Cambro-Ordovician.

A drill-stem test at 10,441-10,575 ft., open 8½ hours, got 14 M.M.c.f.d. with an ungaged flow of condensate reported. Earlier test at 10,442-10,540 ft. got 13 M.M.c.f.d. with a heavy condensate spray. This significant test is located in Section 1, Block 104, Jasper CSL Survey, 2 miles north of a new Clearfork and Canyon Reef discovery, opened by the same operators.

Texas wildcat produces from two Frio sands

A wildcat located more than a mile off the northwest side of the Appling area in northeastern Calhoun County, in Texas' central coastal region, has proved productive from two Frio sands.

The well, Billy Bridewell 1 Ella Peterson de Bord, has a daily openflow potential of 3,300 M.c.f. of gas from its deeper pay at 7,660-82 ft., and 4,300 M.c.f. from the upper zone at 7,535-41 ft.

Gas from both zones is wet, making 1 bbl. 57°-gravity condensate to 75 M.c.f. of gas from the deeper pay, and 20 bbl. of 56.6°-gravity condensate per M.M.c.f. of gas from the other. Shut-in pressures are 2,415 psi. and 2,400 psi., respectively.

Location is in Section 1, of the Wolf Point Ranch Subdivision, about 3 miles northeast of Olivia.

Dual-zone discovery opens new Texas gas areas

A dual-zone discovery by Forest Exploration is opening a new gas-producing area in northwestern Jackson, in the central coastal region of Texas.

Discovery well, 1 J. H. Robinson, is rated good for 10,300 M.c.f.d. from sand at 4,094-97 ft., and 52 M.M.c.f.d. from a shallower pay at 2,408-11 ft. Gas, in both cases, is dry. Shut-in pressures are 1,703 psi. and 952 psi., respectively.

Location is near the Victoria County line and about 3 miles north of the Salem gas-producing area in that county. It is 12 miles northwest of Edna.

Gas-rich Jackson County also had another gas discovery during the week. It is a new sand opened in a workover completion by H. H. Howell in the South El Torro area, southeast of Edna. The pay, perforated at 6,854-58 ft., is the fifth for the well.

The well (1 Fern Llrenzen), drilled in 1959, to depth of 6,928 ft., originally was completed as a dual-zone well at 6,594-96 ft. and 6,455-57 ft. Later, it was worked over and recompleted in pays at 6,104-08 ft. and 5,984-86 ft.

From its new pay, the well is rated good for 5,200 M.c.f.d. of gas, open flow. It has a gas-liquid (52°-gravity condensate) ratio of 30,300 cu. ft. per barrel.

Big Sooner oil pool continues to grow

One of northwestern Oklahoma's most prolific oil pools continues to develop rapidly. Cities Service Petroleum Co. continues to develop the field at 1 Brewer "F" in NW SW 8-21n-14w. The well flowed 160 bbl. of 40°-gravity oil in 5½ hours through 20/64-in. choke from Cherokee Pennsylvanian perforations at 7,075-94 ft.

The field is a combination now of Northeast and Cheyenne Valley fields. The discovery well of Northeast Cheyenne Valley field was J. M. Huber Corp. 1 Phillips in 1958 in C SW SW 33-22n-14w. That well flowed 105 bbl. in 4 hours from perforations at 6,876-6,912 ft. The 1 Case opened the other field in 1959 in C SW NW 7-21n-14w. It flowed 86 bbl. of oil in 4 hours through 22/64-in. choke from perforations in the Cherokee at 7,036-92 ft.

Louisiana field stretches north

Known productive limits of Calcasieu Pass field, on the coast of Cameron Parish, Louisiana, is being extended a mile north by the field's third well.

The new extension well, drilled by W. P. Ballard, also opens a much-deeper pay zone, the third for the area. It is perforated at 10,793-98 ft.

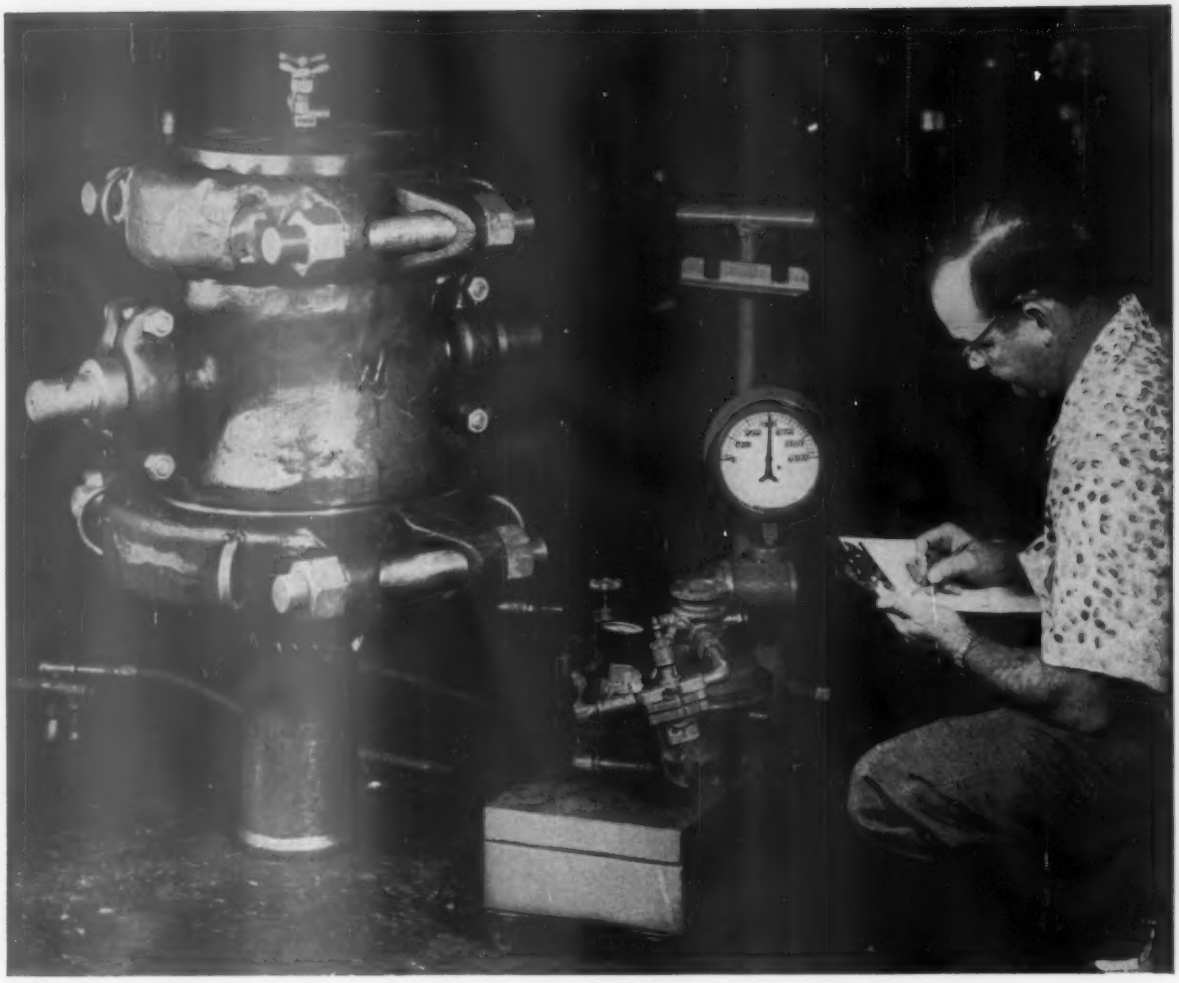
Testing still is under way but flows so far reported range from 1,250 to 1,850 M.c.f.d. of gas through 8/64-in. to 12/64-in. chokes. Liquid recovery from flow through 10/64-in. choke was at the rate of 35 bbl. per M.M.c.f.

The field, located at the mouth of Calcasieu Pass, was discovered

January multiple completions

	Dual oil	Dual gas	Dual oil & gas	Triple oil	Triple gas	Quad. oil
Arkansas	..	1	..	..	..	..
Kansas	..	..	2	..	..	..
Louisiana	33	4	3	6	..	..
South	20	..	2	1	..	..
Offshore	13	4	1	5	..	..
Mississippi	2	..	..	..	..	..
New Mexico	1	4	2	..	..	..
Oklahoma	3	2	..	..	..	..
Texas	21	14	4	2	2	1
Gulf Coast	6	1	..	..	..	..
South	4	7	2	1	2	1
West	7	1	..	..	..	..
East	1	1	1	1	..	..
North	2	..	1	..	..	..
Panhandle	1	3	..	..	..	..
Utah	..	1	..	..	..	..
Total U. S.	60	26	11	8	2	1

Total multiple completions 108.



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late in 1956. Discovery well, drilled by Humble Oil & Refining Co., has gas-produtcion from pay at 6,663-78 ft.

Humble confirmed the discovery 6 months later with another gas well 700 ft. north with production from a slightly deeper zone at 6,883-93 ft. Another test 3,000 ft. farther north proved dry.

New oil pool discovered in Illinois in January

A new oil pool, Shattuc North in Clinton County, has been discovered in Illinois.

There were four extensions to pools, as follows: one oil well each to Glenarm pool in Sangamon County and Browns pool in Wabash County, and one gas well each to Main Consolidated pool in Crawford County and Eldorado Consolidated pool in Saline County.

Five wells—one each in Crawford, Franklin, and Hamilton counties, and two in Jefferson County—were drilled deeper than 4,000 ft. in Illinois. The deepest of these was the C. E. Brehm 2 Donham (an old well drilled deeper) in 21-4s-7e, Hamilton County. The well reached a total depth of 5,566 ft. to test Devonian rocks. It was completed as a dry hole.

Estimated production for Illinois for January is 6,633,000 bbl.

Howard Ranch well hits in Wyoming's Fremont

Gas production from Lance Upper Cretaceous is reported at the Howard Ranch unit discovery in the north-central part of Wind River basin. Discovery well is Shell Oil Co. 23-15 unit, NE SW 15-39n-93w, Fremont County, Wyoming.

The well flowed 2,163 M.c.f.d. from perforations in the Lance at 8,318-8,952 ft. on completion. Location is 11 miles west and north of West Lysite field.

Pair of California gas tests confirmed

TWO RECENT gas discoveries in the Sacramento Valley area of California have been confirmed by offset tests.

Reserve Oil & Gas Co. has been successful in its first stepout in Liberty Island gas field, Solano County, and Atlantic Oil Co. has confirmed its Grimes discovery in Sutter County.

Reserve's 3 Liberty-Farms-Reynolds flowed 3,600 M.c.f.d. of gas through an 18/64-in. choke. The flow came from four perforated intervals, 4,872-77 ft., 4,882-4,905 ft., 4,911-14 ft., and 4,921-26 ft. Tubing pressure during the test was 1,400 psi. The well was taken to a total depth of 5,395 ft. before being plugged back for the tests.

The well is northwest of the discovery in 19-5n-3e. Reserve completed the Liberty Island discovery well in mid-December in the Midland sand of the Meganos-Martinez section of the Paleocene. The discovery flowed 3,900 M.c.f.d. from three perforated zones between 4,726-83 ft.

There is gas production on all four sides of Liberty Island, with the nearest production being 2½ miles south at Cache Slough field and northeast at Liberty Cut field.

Atlantic's stepout, the A-1 Frye unit, is ½ mile east of the discovery well, 1 U. E. Frye. The well is an F zone completion from several intervals. The well flowed 6 M.M.c.f.d. through an 18/64-in. choke during tests of the upper zone at three intervals, 5,950-6,018 ft., 6,034-49 ft., and 6,106-36 ft. Only half this flow was recorded in the lower zone tests, which were taken from perforations at 6,636-63 ft., and 7,190-7,200 ft. The lower zone flow was through 18/64-in. choke.

Significant gas strike made in British Columbia

In British Columbia, Western Natural Gas Co., Inc., announces the completion of its b-70-I (6) Fort Nelson as a gas well with production from the Middle Devonian formation, which flowed at the rate of 10,300 M.c.f.d., on a ½-in. choke, with 1,725-lb. tubing flow pressure. This well has excellent flow characteristics and indicates a major extension of considerable importance for Clarke Lake field in the Fort Nelson area of northeastern British Columbia.

This well is on British Columbia Petroleum and Natural-Gas Permit 144, containing 231,670 acres, and is approximately 6½ miles southeast of the town of Fort Nelson, British Columbia. It is owned by the following: Western Natural Gas Co., Inc. 20%; El Paso Natural Gas Co., 20%; Hudson's Bay Oil & Gas Co., Ltd., 30%; and Union Oil Co. of California, 30%.

Western Natural also announces the completion of its b-30-F (2) Kathy as a Middle Devonian gas well with a flow rate of 9,890 M.c.f.d. on ½-in. choke at 1,525-lb. tubing flow pressure. This well has excellent flow characteristics and indicates another major gas discovery of considerable importance for northeastern British Columbia and western Canada.

This well is 5 miles northwest from the nearest producer—Pacific b-44-C North Kotcho—and 8 miles north of the original Western Natural Gas Co., Inc. 3 Kotcho, field-discovery well of 1958.

The British Columbia Petroleum and Natural-Gas Permit No. 310 on which the b-30-F (2) Kathy is located, comprises 228,859 acres, and is owned as follows:

Western Natural Gas Co., Inc., 25%; El Paso Natural Gas Co., 25%; General American Oils, Ltd.,

Canada well completions for January 1961

	ALL WELLS						WILDCATS				
	Total	Oil	Gas	Dry	Service	Footage	Total	Oil	Gas	Dry	Footage
Western Canada	181	95	28	55	3	1,055,194	55	6	12	37	324,513
Alberta	119	60	23	33	3	813,712	35	5	8	22	231,229
Saskatchewan	42	31	1	10	0	150,466	7	1	1	5	26,444
Manitoba	3	2	0	1	0	5,778	0	0	0	0	0
British Columbia	16	2	4	10	0	82,972	12	0	3	9	64,574
Northwest Territories	1	0	0	1	0	2,266	1	0	0	1	2,266
Ontario	19	6	8	5	0	25,364	...	...	...	...	.....

This is a National torque converter on a T-45 rig. Torque converters are available for applications from 100 to 1,000 hp with a complete range of sizes and circuits to match the speed and power of virtually any engine.

Why you can drill faster, more efficiently, with National Torque Converters

Rigs with National torque converters utilize full-rated engine horsepower to hoist each stand without lugging the engine. The torque multiplication gives a high initial pull to start the string. After starting, power made available by the torque converter is utilized in greater hoisting speed.

Average slush pump horsepower is higher when National torque converters are used. Full engine horsepower is available at all times. Pumps can be run as fast as suction conditions allow.

When rotaries are driven through the torque converter, less shock is transmitted to the pipe, because the fluid cushions any sudden blows coming from a quick-engaging clutch or rough spots in the hole.

If you are interested in repowering your present rigs, National torque converters can be matched with virtually every make of oil field drive. A National Supply representative will be happy to recommend the most economical combination to meet your needs.

If you are buying a new rig, National torque converters are available as original equipment on ten leading makes of rigs. This recognition by rig manufacturers is further proof of value.

It'll pay you to investigate the savings possible with National torque converters. Get complete details by writing to National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pa.

ARMCO National Supply Division

25%; and British Columbia Oil Lands, Ltd., 25%.

Michigan gets best new oil prospect in recent months

Best new oil prospect in months for Michigan is J. O. Mutch 1 Nyland, NE SW NE 34-3n-13e, Macomb Township, Macomb County, 5 miles west of Chesterfield gas pool.

Macomb wildcat was drilled to 4,695 ft., testing Trenton at 3,620 ft., dry, and then plugged back and perforted in the A-1 Saline section at 2,590 to 2,608 ft. Following acid and sand fracture treatments well gaged 2,100 M.c.f.d. gas and averaged 3 to 5 bbl. oil per hour on 8-hour test periods over 4 days.

Utah field gets confirmation test

The confirmation well to Anido Creek field in San Juan County, Paradox basin, Utah, flowed 542 bbl. of oil on a 15-hour test. The important strike is Champlin Oil & Refining Co. 2 Navajo-111, C SW NE 13-43s-24e.

Flow was from perforations at 5,360-80 ft. in the Pennsylvanian Ismay through 30/64-in. choke. Testing continues at this well, the southwest offset and confirmation try to the field discovery which flowed 2,085 bbl. of oil daily recently.

Humble Oil & Refining Co. is taking a drill-stem test at 5,470-5,505 ft. at the northwest offset to the discovery well at 2 Navajo-110, SW SE 12-43s-24e.

Duster drilled near Mexico

Bernard J. Patton, LaJolla, Calif., independent, failed in an effort to find gas in the Imperial Valley of southern California.

Patton's 1 Midway well in 6-11s-21e in Imperial County, has been abandoned as a dry hole at 3,809 ft. The test is 36 miles north of the Mexican border and 20 miles southwest of Blythe, Calif.

Lansing oil field opens in northwestern Kansas

Rawlins County in northwestern Kansas' Cambridge arch country has a new Lansing-Kansas City oil pool. Discovery well is Blair Associates and Murfin Drilling Co. 1 Walsh in C NW SE 15-1s-32w.

The well pumped 40 bbl. of oil daily from perforations at 4,071-74 ft. Location is 6½ miles northwest of Herndon and 1½ miles east of Wilhelm Lansing-Kansas City field.

Ohio's Washington adds Newburg gas pay

In Ohio, finding of Newburg production in Washington Township, Richland County, was announced by the operator, E. C. McManaway.

Natural production of 1,630 M.c.f.d. was gaged on 1 Dyol Donough, Section 25, in the pay from 2,297 to 2,314 ft. Rock pressure in 24 hours was reported as 730 psi.

This strike is more than 5 miles southeast of the old Mansfield Newburg pool in Madison Township, Richland County.

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Discovery wells

ARKANSAS

Franklin County:
Mull Drilling Co., Inc., 1 N. L. Mayner, 28-10n-26w, 2¾ miles northeast of Ozark. IP 9,600 M.c.f.d., calculated open-flow, shut-in 900 psi., perf. 3,080-93 ft., 3,316-20 ft., 3,329-38 ft., 3,344-48 ft., and 3,408-30 ft., Cecil series; and 4 M.M.c.f.d., calculated open flow, shut-in 850 psi., perf. 3,693-3,704 ft., Orr sand. TD 4,110 ft. New pay (Cecil series) and extension in Ozark field.

Pope County:
Gulf Oil Corp. 1 Ida Jones, 18-9n-20w, 2½ miles northwest of Dover. IP 3,089 M.c.f.d., shut-in 871 psi., perf. 3,063-76 ft., Atoka-Casey sand, TD 5,285 ft. Discovery well of New Hope field.

WESTERN CANADA

Alberta:
Cities Service 10-20 Mound, LSD 10, 20-34-3w5. Cardium oil discovery. TD 8,400 ft.
Pan American D-1 10-2 Carnwood, LSD 10, 2-47-6w5. Mississippian gas discovery. TD 6,760 ft.
TGT 10-36 Ante Creek, LSD 10, 36-67-24w5. Permo Penn gas discovery. TD 6,455 ft.
Amerada Crown CG 6-5 Williston Green, LSD 6, 5-42-7w5. Shut in gas discovery. TD 8,340 ft.
Champlin-APCO 6-21 Raven River, LSD 6, 21-35-5w5. Gas discovery. TD 9,282 ft.

British Columbia:
Triad-BP c-88-I Pickell Creek, c-88-I-94-H-3. Bluesky gas discovery. TD 4,054 ft.

Saskatchewan:
Tidewater 4-36 Kenosee Crown, LSD 4, 36-10-3w2. Mississippian oil discovery. TD 4,001 ft.

COLORADO

Garfield County:
Southern Union Gas Co. 1 Gross-Hahnewald, SE NE 8-7s-94w. IPF 1,411 M.c.f.d., 2-in. line, back press. 600 psi., SITP 1,784 psi., Mesaverde 6,180-7,394 ft. Mesaverde discovery, new field. TD 7,560 ft. PBTD 7,462 ft.

Rio Blanco County, Lower Horse Draw:
Alamo Corp. 1 unit, NW NW 15-2s-103w. IPF 411 M.c.f.d., ¼-in. choke, CP 289 psi., Emery open hole 2,756-2,920 ft. TD 2,920 ft. Emery discovery, new field.

ILLINOIS

Jefferson County:
James J. Hurt 1 Silas E. Brockman, NW SW NW 3-2s-4e. IP 184 BOPD, McClosky 2,932-37 ft. TD 2,937 ft. Opens North Oakdale pool.

INDIANA

Warrick County:
R. Tennyson 1 H. Woolsey, SE NE NW 21-4s-6w. IP 30 BOPD, O'Hara 1,206-9 ft. TD 1,225 ft. Opens East Heilman pool.

KANSAS

Barton County:
Nadel & Gussman 1 Eveleigh "B," C N½ NE NW 8-18s-12w. IP 135 BOPD, 40°, Arbuckle 3,351-55 ft. TD 3,355 ft. Opens Southeast Redwing oil field.

Grant County:
Hugoton Production Co. 2-22 Schmidt, C SW NE 22-30s-38w. IPF 887 M.c.f.d., Council Grove Permian 2,818-93 ft. TD 5,950 ft. New gas discovery.

Haskell County:
Cities Service Oil Co. 1 Blair "B," C SE NW 32-30s-33w. IP 192 BOPD, 39°, Lansing 4,128-38 ft. TD 5,663 ft. Opens Victory pool.

Kingman County:
Drillers Production Co. 1 Kostner, NE NE NE 30-28s-5w. IP 33 BOPD, 17 BWPD, 35°, Mississippian 3,886-92 ft. TD 3,892 ft. Opens West Broadway pool.

Marion County:
Texstar Petroleum Co. 1 Jewett, SW SE NW 9-19s-5e. IPF 5,680 M.c.f.d., Miss. chat 2,184-2,219 ft. TD 2,265 ft. New gas discovery.

Morris County:
M. A. Murphy 1 Shields, SW SW NW 17-17s-5e. IP 5 BOPD, 100 BWPD, Miss. chat 2,291-2,330 ft. TD 2,330 ft. New oil pool.

Rooks County:
John O. Farmer, Inc., 1 Collins, C N½ SW SE 34-9s-18w. IP 80.4 BOPD, 24°, Simpson dolomite 3,659-62 ft. TD 3,709 ft. Opens Collins field.

KENTUCKY

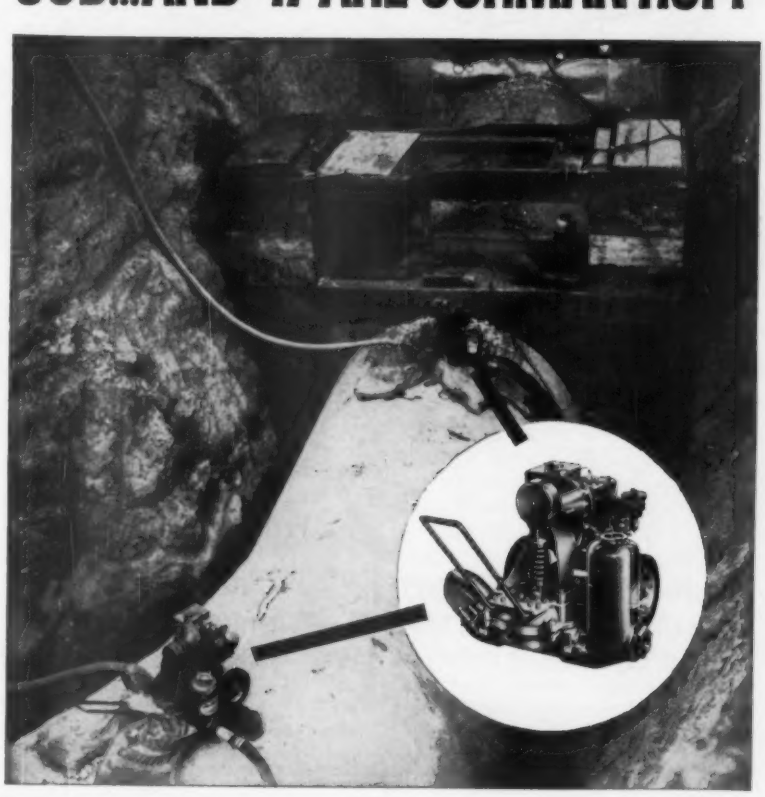
Hancock County:
Jess Ashby and Wayne Scholl 1 Condit-Emmick, 18-R-32. IP 40 BOPD, Aux Vases 985-992 ft. TD 992 ft. Opens Louisport pool.

EAST TEXAS

Houston County:
Pure Oil Co. 12 W. T. Bruton Estate, Barton Clark Sur., A-23, 7 miles northeast of Midway. IP 264 BOPD, ¼-in., 48.5°, GOR 2,708 cu. ft. per bbl., TO 1,200 psi., perf. 10,576-94 ft., Glen Rose. TD 12,810 ft. New pay in Fort Trinidad field.

(Continued on page 218)

57 DIAPHRAGM PUMPS ON THIS JOB...AND 47 ARE GORMAN-RUPP



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John C. Duffy . . . entered the oil business by accident.

Duffy—Friend of Geologists

• Youthful vice president of a growing independent firm believes good geologists tip the balance in exploration.

"THE DAY of lucking into reserves is gone, and I don't see how a company or individual can succeed in exploration without competent geologists."

That isn't a rockhound talking. It's John C. Duffy, vice president of Murphy Oil Co. of Oklahoma, Inc., an aggressive independent which has production in nine states and explores in others.

"We all know we are going to make land plays that don't require much geology," he tells you firmly, "but the bread and butter of exploration is in well-founded geological prospects."

This friend of geologists is a husky, 41-year-old native of Philadelphia who got into the oil business more or less by accident.

Duffy was still in high school when his father, a Philadelphia city fireman, died. After graduation, Duffy spent some time as a professional baseball player in the Philadelphia Phillies' chain. Then he enrolled at Villanova University, and while there he heard Murphy Oil Co. of Pennsylvania had a clerk's job open in accounting.

Duffy needed money to help his family. He took the Murphy job and continued at Villanova in night classes, concentrating on business administration.

Then came the war. In 1943 Duffy entered the Army Air Corps and won a commission as a navigator.

Moving up . . . After his discharge, Murphy set up a training program for Duffy. Obviously management saw a future executive in the young veteran.

Duffy worked with production and land people until 1951, when the company created Murphy Oil of Oklahoma to handle its operations outside the Appalachian area.

He was made assistant treasurer of the subsidiary, and became treasurer soon after he moved to the Tulsa headquarters of the new outfit. In 1954 Louis P. Bristol was named president of Murphy of Oklahoma, and Duffy was chosen as his assistant.

Duffy stepped up to vice president in charge of operations in 1958. He ramrods production, exploration, and other activities in Oklahoma, Kansas, Nebraska, Colorado, Indiana, Illinois, Kentucky, Michigan, Wyoming, Texas, and Louisiana.

A novel venture . . . Last year, Murphy of Oklahoma proved it has a flexible approach to exploration (OGJ, May 9, 1960, p. 102).

With five other small independents, the company set up a program to drill 14 wildcats in the promising but deep and expensive Miocene area of southern Louisiana.

The combine's first wildcat was a dry hole. The second well is now being drilled in Bayou Segnette field.

Duffy says the pooling of cash and talents in the $3,000,000 long-range program is working out fine. No friction has occurred between the independents, which also include Keener Oil, Tulsa; Eason Oil, Oklahoma City; Great Lakes Carbon Corp., New York; and W. C. McBride, Inc., and Minerva Oil, both of St. Louis.

There's a quiet enthusiasm in Duffy's voice when he talks about his company's plans. In recent years, Murphy of Oklahoma has gone in extensively for secondary-recovery projects. Hopes for the future include a step-up in Texas Gulf Coast exploration, and the company has opened a branch office in Corpus Christi to promote this activity.

That gets back to the geologists. Murphy of Oklahoma has a three-man geological department at Tulsa, and eventually will have two geologists in the Corpus Christi office.

Duffy credits a faith in geologists as "the thing that ties together" the independents in the South Louisiana wildcat project.

"All six are sold on the absolute necessity of a sound geological approach," he says.

●

▶▶▶ Personals

G. L. Freeman, construction and maintenance supervisor for Shell Oil Co.'s Toledo district, has retired after 30 years with the company.

Russell J. Ford, southern Oklahoma district geologist for Sunray Mid-Continent Oil Co., has been named district geologist for the new western exploration district, Oklahoma City. **Carl E. Davis,** southern Oklahoma district land man, will be western district land man. Sunray's southern and western Oklahoma exploration districts have been combined to form the new Oklahoma City unit.

Personals

Theodore W. Nelson, technical adviser in the producing department of Socony Mobil Oil Co., has been named manager of production. Nelson has been with Socony since 1934. **Paul E. Mostini** has been appointed executive assistant to the assistant general manager of producing and manufacturing for Mobil Oil Francaise, an affiliate. **Jean Moulier,** district sales manager in equatorial Africa, will succeed Mostini in the Paris liaison office.

NELSON

David P. Phillips, geologist with Humble Oil & Refining Co., has been transferred to Wolf Point, Mont., from Billings, Mont. **J. R. McCreight,** geologist and **W. K. Calmes,** scout, in Worland, Wyo., have been transferred to Riverton, Wyo.

B. B. Graves has been named petroleum - products division foreman in the cracking department at Humble Oil & Refining Co.'s Baton Rouge refinery. He had been head of the chemical-products equipment engineering group, mechanical-engineering department.

J. A. Rhodes, district superintendent in charge of drilling and production operations for Texaco Inc. in Tulsa, **H. G. Bostian,** district engineer, and **K. B. Hatfield,** district accountant, have been transferred to Oklahoma City from Tulsa.

D. G. Kingman, Mobil Oil Co., has been elected president of Petroleum Production Pioneers, Los Angeles. He succeeds **E. (Pick) McIver,** consultant, who has been named honorary vice president. **Sam Grinsfelder,** Union Oil Co., retired, has been named honorary president. Other officers are **Basil Kantzer,** Union Oil, vice president; **Floyd Vaughn,** Halliburton Co., treasurer; **Paul Andrews,** Signal Oil & Gas Co., historian; **Hugh Gribbin,** Macco Corp., sergeant-at-arms; and **Elmer Olsen,** reelected secretary.

John D. Juilfs, geologist with Continental, has been transferred to Roswell, N. M., from Jackson, Miss.

Don Teason has been transferred by Skelly Oil Co. from Denver to Bismarck, N. D., where he will be district geologist. He succeeds **Andy Masson,** now in Wichita.

N. B. Sauvé, retired manager of producing and exploration operations in the Philippines for Standard-Vacuum Oil Co., has been appointed a director of Oil Drilling & Exploration, Ltd., Sydney, Australia. Sauvé retired from Stanvac last year.

J. G. Willis, Continental Oil Co., has been elected president of the Oil Men's Club of Kansas City. Other officers are **G. H. Priggin, Jr.,** Mobil Oil Co., first vice president; **R. F. Moore,** Platte Pipe Line Co., second vice president; and **W. A. Sladek,** Butler Manufacturing Co., secretary-treasurer.

Lawrence Myers has been transferred by Amerada Petroleum Corp. from Billings, Mont., to Tulsa, as division supervisor for West Texas and southeastern New Mexico. **William H. Sampsel,** Calgary, will succeed Myers as Billings district geologist. **H. T. Ashmore** and **J. D. Smith,** geologists, have been transferred from Billings to Williston, N. D. **Miles W. Pepper, Keith L. Mohl,** and **Fred Julian** have been transferred from Williston to Billings.

William G. Helis, Jr., New Orleans independent operator, has been elected president of the New Orleans Petroleum Club. Other new officers are **E. F. Banks,** Olin Oil & Gas Corp., vice president; **Charles G. Cary,** Freeport Oil Co., secretary; and **Thomas C. Nugent,** California Oil Co., treasurer.

John T. McCoy, coordinator of Tidewater Oil Co.'s eastern division manufacturing department, has been elected president of Coordinating Research Council, Inc. The council, sponsored by American Petroleum Institute and Society of Automotive Engineers, conducts research on fuels, lubricants, and automotive equipment.

H. Boyd Moreland, reservoir engineer for Texaco Inc., has been transferred to Oklahoma City from Tulsa. **Elton G. Yates,** field engineer in Escobas, Tex., has been transferred to Liberty, Tex., as reservoir engineer.

K. R. Gerhart, assistant to the general manager of petrochemical manufacturing for Continental Oil Co., has been promoted to manager of manufacturing, petrochemical department. He will continue to headquarter in Houston. **J. D. Burns,** assistant superintendent of the Gretna, La., petrochemical plant, has been promoted to technical assistant to the manager of petrochemical manufacturing with headquarters in Houston.

E. F. Bullard, Tulsa, and **L. W. Moore,** Chicago, have been elected directors of Standard Oil Co. (Ind.). Bullard is chairman and former president of Pan American Petroleum Corp., Indiana Standard's exploration and production subsidiary. Moore is president of American Oil Co., marketing and manufacturing subsidiary.

BULLARD

MOORE

Kenneth L. Nelson, has been appointed Houston division operations superintendent for Mobil Oil Co. Nelson was Corpus Christi, Tex., district superintendent before being assigned to the Houston division office last year.

J. N. Holland, Rockwell Manufacturing Co., has been elected 1961 chairman of Southwest Texas section of AIME's Society of Petroleum Engineers. He succeeds **Joseph J. Lawnick,** American Petrofina. Other officers are **Carrol Hudson,** Atlantic Refining, first vice chairman; **E. G. Wagenecht,** Pan American Petroleum, second vice chairman; and **J. W. Culberson,** Republic Natural Gas Co., secretary-treasurer.

▶▶▶ Personals

HULL

Charles Hull has been appointed general manager of Stanlow (Cheshire) refinery of Shell Refining Co., Ltd. He succeeds **C. R. Middleton,** who has retired after 35 years with the Royal Dutch-Shell group. Hull has been with group since 1937 and has served in Sarawak and Sumatra as well as in the United Kingdom.

Harry D. Campbell has been elected president and general manager of McElroy Ranch Co. He will headquarter in Bakersfield, Calif. Campbell was president of Franco Western Oil Co. before its merger with McElroy Ranch in December.

P. C. Livesay, deputy coordinator of manufacturing for Standard Oil Co. (Ind.) in Chicago, has been appointed coordinator of manufacturing and purchases. Livesay was manager of the company's Sugar Creek, Mo., refinery before moving to Chicago last month.

H. D. Kinsey has been elected a vice president of Union Carbide Corp. **Paul L. Alspaugh,** vice president of Union Carbide Olefins Co. division, has been named to succeed Kinsey as president of Union Carbide Olefins.

C. H. Marshall has been promoted to division engineer in the cracking and light-ends division at Humble Oil & Refining Co.'s Baytown, Tex., refinery. He heads the technical department of that division. **R. E. Payne** has been promoted to staff engineer, technical division.

B. A. Street has been promoted to chief geologist of Pubco Petroleum Corp. and transferred to Albuquerque from Casper, Wyo. **N. E. Maxwell, Jr.,** production manager, has been transferred to Albuquerque from Aztec, N. M. **James E. Holdeman,** Albuquerque, has been transferred to Casper as senior area geologist. **Wendell A. Cole,** geologist with Ohio Oil Co. in Durango, Colo., has joined Pubco as area geologist in Albuquerque.

M. H. Harris has joined Gulf Research & Development Co.'s production-engineering division as research engineer. He had been with Ohio Oil Co.

C. L. Parris, manager of Amoco Chemicals Corp.'s aromatic - acids plant at Joliet, Ill., has been named plant manager of the company's new Haverhill, Ohio, facilities. **Jerald D. Reed,** manager of Amoco's Texas City plant, will succeed Parris in Joliet. **Fred F. Diwoky,** assistant to the general manager of manufacturing in Chicago, will succeed Reed.

Frank P. Peterson, president of Southern Minerals Corp. and Southern Pipe Line Co., has been elected chief executive officer. He succeeds **Maston Nixon,** former chairman, who will remain as a director and consultant to Peterson.

L. L. Sevier, superintendent of compressor stations for Cities Service Gas Co., has been transferred to Ellsworth, Kans., from Matfield Green, Kans.

J. R. Anderson has been named superintendent of Buckeye Pipe Line Co.'s Cleveland trunk line division. He will continue as superintendent of gathering lines. **Richard Garnjost** has been named assistant superintendent, trunk line and gathering divisions.

Harry O. McLeod, superintendent of Arkansas Pipeline Corp.'s oil pipeline division, has been named superintendent of the new Cities Service Pipe Line Co. division formed to operate the Arkansas Pipeline system. **W. M. Kyger** will be engineer in the Shreveport, La., division office. Three district offices in the new division will be managed by **Carl Burnham,** district superintendent for East Texas in Longview; **E. B. Jones,** Arkansas-North Louisiana district superintendent in Haynesville, La.; and **L. M. McKenzie,** northwestern Louisiana superintendent in Oil City.

Curtis H. Albitz, vice president of Texas Pipe Line Co. in Houston, has been named manager, distribution - planning division, in the New York supply and distribution department of Texaco Inc.

A. H. Weyland has been named superintendent of Cities Service Petroleum Co.'s new Arkansas-Louisiana - Texas production division. He will headquarter in Shreveport, La. The new division is result of recent consolidation of Arkansas Fuel Oil and Cities Service production properties. **E. L. Cook** has been named assistant division superintendent. **O. G. Byrd** is oil engineer, **H. L. Williams,** gas engineer, and **J. F. Brock,** division clerk. District superintendents in the new division are **R. M. Sloan,** Oil City, La., district; **G. C. Wellborn,** Haynesville, La., district; **G. F. Phillips,** Tullos, La.; **Arden Waggoner,** Longview, Tex., and **W. F. Siebenmorgan,** Carthage, Tex.

WEYLAND

Vance Fulton has been named to succeed **Claude Wilson** as superintendent of maintenance at Pure Oil Co.'s Toledo refinery. Wilson has been transferred to Chicago.

J. B. Ballem, chief legal adviser for Pacific Petroleums, Ltd., has been named manager of marketing. He succeeds **H. W. Gustafson. John Anderson** will replace Ballem as chief legal adviser.

C. E. Greenwood, administrative assistant to **L. F. McCollum,** Continental Oil Co. president, has been promoted to manager of the land section. He will continue to headquarter in Houston.

Kenneth Nugent, McCullough Tool Co., has been elected president of California Coastal section of AIME's Society of Petroleum Engineers. Other officers include **K. F. Pilgram,** Shell Oil Co., vice president and program chairman; **T. W. Simmons,** Texaco, secretary; and **Gay Rieder,** Welex Inc., treasurer. Committee chairmen are **J. M. Cadden,** Tidewater, activities; **J. S. Stewart,** Shell, membership; and **D. K. Howard,** Texaco, public affairs.

Personals

Stewart P. Coleman, vice president and a director of Standard Oil Co. (N. J.), will retire April 1 for reasons of health.

Coleman has been with the Jersey companies since 1920. He became a director in 1946 and vice president in 1955. He was first manager of the Jersey coordination and economics department and has been chairman of the coordination committee. He is a member of Jersey's board advisory committee on investments. During World War II, Coleman served with the Petroleum Industry War Council and Petroleum Administration for War.

John A. Norton, projects coordinator at Humble's Bayonne, N. J., refinery, has been named head of the new mechanical technical-service division in the Bayonne technical department.

Claron H. Madsen has joined Kern County Land Co. in Midland, Tex., as exploration geologist. He formerly was with Midstates Oil Corp. and Tennessee Gas Transmission Co.

Martin A. Row has been named special counsel for foreign operations in Sun Oil Co.'s production department. He succeeds **John W. Timmins,** now retired. Row will continue as counsel for regulatory and natural-gas matters with headquarters in Dallas.

J. W. Haggard, petroleum engineer with Cities Service Petroleum Co. in Great Bend, Kans., has been promoted to district engineer in Guymon, Okla.

Richard L. White, geophysicist with Standard Oil Co. of California in Seattle, has been transferred to Jackson, Miss., as geophysicist for Chevron Oil Co.

T. J. Eby, Jr., exploitation geologist with Sohio Petroleum Co. in Oklahoma City, has joined Texas Pacific Coal & Oil Co. in Lafayette, La., as staff geologist.

Jim Thornton, Texaco Inc., has been elected chairman of the Billings, Mont., petroleum section of AIME's Society of Petroleum Engineers. He succeeds **Nick Matthews,** Shell. Other officers are **Bob Spottswood,** Shell, first vice chairman; **Bob Watkins,** Montana Oil and Gas Conservation Commission, second vice chairman; **Joe Bato,** McAlester Fuel Co., secretary-treasurer; and **Guy Lookabaugh,** Humble, and **Toby Hoenshell**, consultant, directors.

Wayne E. Glenn, Houston, and **J. P. Malott,** Los Angeles, have been elected vice presidents of Continental Oil Co. Glenn, former general manager of the production department, will be vice president and executive assistant to **Charles A. Perlitz, Jr.,** executive vice president. Glenn will continue to headquarter in Houston. Malott, general manager of the western region, will be vice president and general manager of production with headquarters in Houston.

M. R. Hayes has been named manager of Phillips Petroleum Co.'s new general-services department. Hayes was manager of Canadian operations before Phillips sold its Canadian holdings to Pacific Petroleums, Ltd.

Elgin Flott has joined Hyland Oil Corp., Salt Lake City, as exploration geologist. He had been with Ohio Oil Co. in Salt Lake City.

Dr. Carl S. Kelley, project engineer with Phillips Petroleum Co., has been transferred to Sweeny, Tex., from Alhambra, Calif.

E. L. Collins, district geophysicist for Tennessee Gas & Oil Co., has been transferred to Wichita from Wichita Falls, Tex.

Marcus Hoppes, Tulsa district drilling and development engineer for Texaco Inc., has joined Apache Corp. He will headquarter in Tulsa.

Joe W. Jackson, Denver exploration superintendent for Sinclair Oil & Gas Co., has been transferred to Midland, Tex., in the same capacity. **C. C. Tinkler,** Midland division exploration superintendent, will take over the same post in Denver. **Warren Bald,** assistant Denver division geologist, has been transferred to Roswell, N. M., and **A. A. Koenig,** assistant division geologist in Albuquerque, has been transferred to Denver.

Deaths

Ralph W. Hayman, 66, retired general marine agent in charge of Gulf Oil Corp.'s East Coast tanker fleet, died February 1 in a Philadelphia hospital. He retired in 1958.

Joseph Kayser, 83, retired foreman for Standard Oil Co. (Ohio), died February 3 at his home in Lima, Ohio, after a long illness.

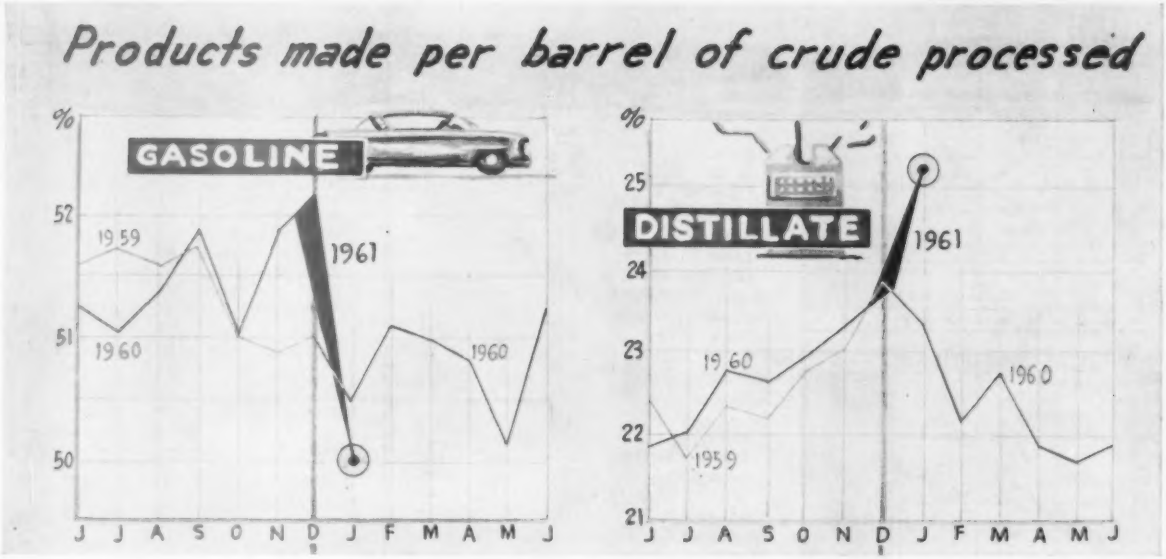
Frank E. Packard, 87, retired general counsel and tax attorney for Standard Oil Co. (Ind.), died February 9 at his home in Oak Park, Ill. Packard retired in 1946. He had been executive director of the Western Tax Council since 1948.

Edward N. Rehler, 78, owner of Allegany Development Royalty Co., died February 4 at his home in Allegany, N. Y. He had been oil operator and lease broker in New York, Pennsylvania, and Ohio for many years.

Joseph V. Murray, 72, who retired in 1954 after 37 years with Texaco Inc. and California Texas Oil Corp., died February 11 in St. Petersburg, Fla. He had spent a large part of his career in the Far East, and was one of the original directors of Caltex.

Henry James Wolf, 67, lubrication engineer with the old General Petroleum Corp. for 24 years, died February 9 in a Los Angeles hospital.

Leon J. Cummins, Oil City, Pa., oil producer, died February 12 in an Oil City convalescent home.



Heating demands force shift in yields

BY JOHN C. CASPER

REFINERS SHIFTED product yields in January to cover the big jump in distillate demand. They also increased refinery runs.

However, the cutback in gasoline yield was greater than the jump in runs. The result was a slight decrease in gasoline production compared with December. (See charts on page 77.)

Points for the lines in the above charts were calculated by dividing total refinery production of gasoline and distillate by crude input. Figures for December and January are from weekly API reports. All other data are from Monthly Petroleum Statements by the Bureau of Mines. The ratio of output to crude runs was selected because weekly reports do not give information on volumes of natural-gas liquids blended in the production of gasoline. Also missing is the net amount of unfinished oils reprocessed each week.

Note that the January yield of gasoline was the lowest in the past year. Total production of gasoline was down to 50% of average crude input for the month. However, the January drop was exaggerated by the abnormally high ratio in December. Weekly reports for December showed gasoline production at 52% of crude runs. That was the highest ratio for 1960.

Most of the decrease in January gasoline yield can be credited to those districts needing more distillate to meet the big demand for heating oils. The small table gives gasoline yield comparisons for January, December, and January 1960.

Major distillate markets are on the East Coast or in the north-central area. Refiners supplying these areas had to shift yields from gasoline to distillate. Note January reductions in gasoline yields for the following districts: East Coast, North Central, Mid-Continent, Texas Gulf, and Louisiana Gulf.

A quick look at the highlights . . .

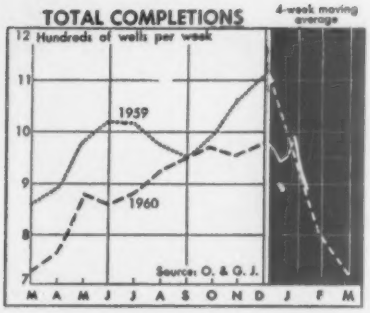
	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,161,945	UP	29,885	DOWN	49,008
Crude stocks	233,221,000	DOWN	2,883,000	DOWN	16,750,000
Completions	782	UP	56	UP	20
Refinery runs	8,405,000	UP	108,000	UP	328,000
Gasoline stocks	215,330,000	UP	981,000	UP	6,422,000
Kerosine stocks	25,014,000	DOWN	975,000	UP	1,305,000
Distillate stocks	100,540,000	DOWN	6,142,000	DOWN	17,800,000
Residual stocks	42,137,000	DOWN	1,270,000	DOWN	5,901,000
Four-product stocks	383,021,000	DOWN	7,406,000	DOWN	15,974,000
Total imports	1,778,900	DOWN	411,900	DOWN	313,100

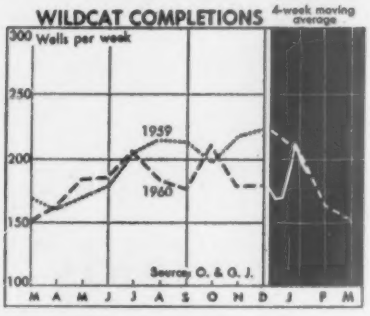
GASOLINE PRODUCED FOR EACH BARREL OF CRUDE RUN

(Gallons)

	Jan. 1961	Dec. 1960	Jan. 1960
East Coast	*18.69	*19.20	18.44
Appl. 1	17.56	18.19	16.01
Appl. 2	21.55	21.23	21.15
Ind., Ill., Ky.	20.96	*21.91	21.45
Minn., Wis., Dak.	20.54	20.11	20.16
Okla., Kans., Mo.	*23.10	*23.89	22.72
Inland Texas	30.37	31.34	29.38
Texas Gulf Coast	*21.04	*22.49	21.13
La. Gulf Coast	*21.80	*23.79	22.01
N. La. and Ark.	24.61	23.27	29.24
New Mexico	24.11	23.00	23.50
Other R. Mtn.	20.96	21.44	20.13
West Coast	18.94	18.83	20.28
Total U. S.	21.00	21.82	21.22

*January reduction.





Active Rotary Rigs

	2-13-61	2-6-61	2-15-60
Alabama	6	7	3
Alaska	7	7	(*)
Arkansas	13	13	13
Arizona	1	1	0
California	62	68	69
Land	60	64	64
Offshore	2	4	5
Colorado	22	22	26
Florida	2	3	1
Land	1	2	0
Offshore	1	1	1
Illinois	32	32	15
Indiana	6	9	4
Indiana	6	9	4
Iowa	0	0	1
Kansas	100	103	80
Kentucky	4	2	7
Louisiana	254	250	295
North	21	21	30
S. Inland waters	96	94	120
S. Land	84	84	96
Offshore	53	51	49
Michigan	21	22	32
Mississippi	44	36	80
Missouri	1	1	2
Montana	19	19	11
Nebraska	18	22	17
Nevada	1	1	0
New Mexico	98	92	83
North Dakota	15	11	17
Ohio	4	4	3
Oklahoma	168	175	175
Oregon	1	1	0
Pennsylvania	7	6	10
Texas	498	525	589
S. Inland waters	6	5	6
S. Land	130	142	158
Offshore	1	1	0
North	43	45	42
Panhandle	48	51	50
East	36	41	51
West Central	†128	†136	198
West	106	104	84
Utah	24	25	27
Washington	1	1	1
West Virginia	7	7	3
Wyoming	43	47	54
Total U. S.	1,479	1,512	1,618
Western Canada	195	192	242
Eastern Canada	0	0	4
Grand total	1,674	1,704	1,864

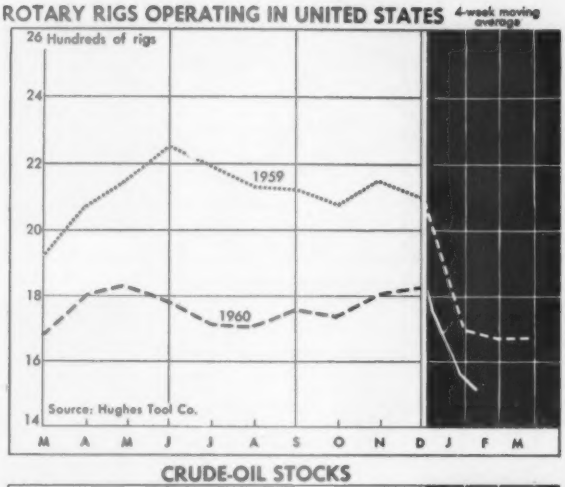
Hughes Tool Co. report. *Data first reported 4-4-60. †Stephens and Eastland counties now included in West Central.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED FEBRUARY 11, 1961

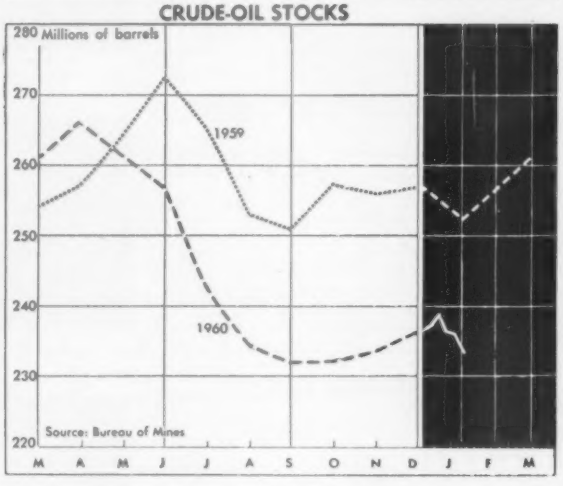
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Arkansas	10	3	0	3	4	0	40,739	57	72	6	0	0	2	4	20	19
California	32	22	0	4	5	1	137,404	236	175	6	0	0	2	4	31	37
Colorado	6	1	0	0	5	0	25,991	83	92	5	1	0	0	4	51	47
Illinois	49	12	0	1	13	23	104,477	243	308	7	0	0	1	6	48	73
Indiana	6	1	0	0	5	0	10,179	90	121	0	0	0	0	0	14	41
Kansas	105	47	0	6	31	21	273,764	642	446	19	3	0	2	14	126	144
Kentucky	7	2	0	0	5	0	10,693	156	295	0	0	0	0	0	14	35
Louisiana	42	20	1	3	18	0	282,224	471	442	4	0	0	0	4	65	58
North	20	10	0	3	7	0	67,810	172	152	2	0	0	0	2	26	27
South	18	7	1	0	10	0	172,354	231	220	1	0	0	0	1	36	28
Offshore	4	3	0	0	1	0	42,060	68	70	1	0	0	0	1	3	3
Michigan	14	5	0	1	8	0	47,045	95	89	3	0	0	0	3	43	34
Mississippi	8	2	0	0	6	0	74,130	83	92	6	0	0	0	6	33	35
Montana	13	4	0	0	9	0	64,069	50	40	4	0	0	0	4	22	22
Nebraska	12	7	0	0	5	0	51,133	75	94	6	1	0	0	5	35	36
New Mexico	43	22	0	6	15	0	173,184	204	264	10	1	0	0	9	31	35
West	11	5	0	4	2	0	47,632	90	92	1	0	0	0	1	13	7
East	32	17	0	2	13	0	125,552	114	172	9	1	0	0	8	18	28
New York	4	0	0	2	2	0	10,707	119	50	2	0	0	0	2	2	5
North Dakota	4	4	0	0	0	0	26,674	29	38	1	1	0	0	0	6	7
Ohio	17	9	0	5	3	0	49,218	113	166	1	1	0	0	0	7	9
Oklahoma	121	57	4	7	39	14	430,020	584	495	22	1	1	2	18	77	100
Pennsylvania	0	0	0	0	0	0	0	50	6	0	0	0	0	0	4	2
Texas	239	128	8	16	85	2	1,008,025	1,787	2,123	43	1	0	0	42	394	460
Dist. 1	24	13	1	0	10	0	61,587	106	164	7	0	0	0	7	39	64
Dist. 2	9	0	1	0	8	0	62,950	97	90	5	0	0	0	5	20	24
Dist. 3	13	4	0	0	9	0	66,456	141	180	3	0	0	0	3	36	35
Dist. 4	13	3	0	2	8	0	74,426	177	186	5	0	0	0	5	49	55
East	23	14	1	0	8	0	98,828	149	177	2	0	0	0	2	35	38
Dist. 7-B	34	13	0	5	16	0	97,517	248	273	8	0	0	0	8	74	80
West	61	40	3	1	15	2	320,918	414	584	8	0	0	0	8	86	98
Dist. 9	34	24	1	1	8	0	100,266	286	359	4	1	0	0	3	42	59
Dist. 10	28	17	1	7	3	0	125,077	169	110	1	0	0	0	1	13	7
Utah	4	1	0	0	3	0	13,842	22	35	3	1	0	0	2	17	13
West Virginia	21	0	0	20	1	0	57,894	120	92	0	0	0	0	0	0	1
Wyoming	18	5	0	4	9	0	96,519	133	119	7	1	0	0	6	57	50
Miscellaneous*	7	2	0	1	4	0	39,020	52	22	4	0	0	0	4	42	12
Total U. S.	**782**	354	13	79	275	61	3,026,951	5,494	5,670	**159**	12	1	9	137	1,139	1,275
Previous week	726	340	6	53	264	63	2,706,757	.....	.....	132	5	2	7	118	.....	.....
Cum. 1961	5,494	2,470	164	490	2,040	330	22,591,934	.....	.....	1,139	86	19	42	992	.....	.....
Cum. 1960	5,670	2,670	191	482	2,165	162	24,658,220	.....	.....	1,275	116	13	39	1,107	.....	.....
Western Canada	28	9	0	7	11	1	165,223	277	252	14	1	0	4	9	81	71

*Alaska, Alabama, Missouri, Washington.

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	2-4-61	1-28-61	2-6-60
Pennsylvania	2,127	2,100	2,317
Other Appalachian	1,234	1,272	2,062
Illinois, Indiana, Michigan	8,754	8,535	9,540
Nebraska and North Dakota	2,694	2,715	2,602
Kansas	9,076	9,103	9,910
Oklahoma	15,390	15,522	16,798
Arkansas	1,683	1,772	2,222
Louisiana	18,620	17,638	18,915
North	3,256	3,150	2,853
South	15,364	14,488	16,062
Mississippi, Alabama, Florida	1,947	1,994	2,296
New Mexico	7,452	7,371	7,446
Texas	97,800	100,402	105,489
East Texas	8,206	8,291	7,869
West Texas	44,601	45,063	48,637
Texas Gulf	16,650	18,380	19,150
Other Texas	28,343	28,668	29,833
Wyoming	17,064	17,042	17,396
Other Rocky Mountain	10,104	10,469	9,395
California	25,353	25,139	28,643
Foreign	†13,953	15,030	14,940
Total	**233,221**	236,104	249,971

*Bureau of Mines. †Includes 4,992,000 bbl. in California.

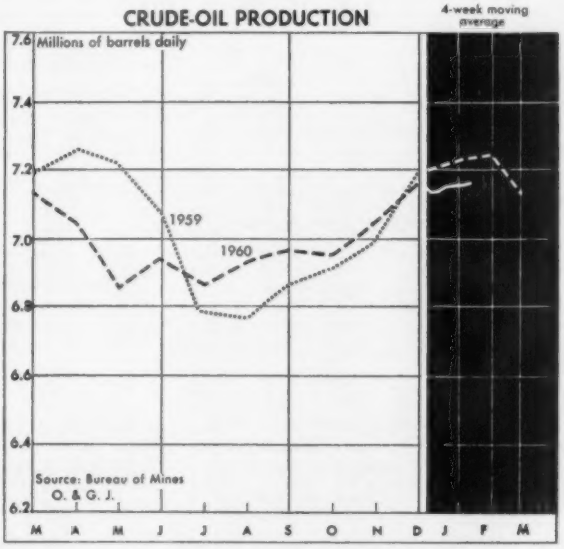
DAILY AVERAGE PRODUCTION FOR WEEK

	February 11, 1961			Feb. 4
	Crude oil	Lease condensate	Total	total
Alabama	20,870	.....	20,870	21,425
Alaska	7,000	.....	7,000	6,600
Arkansas	78,025	150	78,175	78,125
California	825,500	.....	825,500	828,000
Colorado	131,800	.....	131,800	131,400
Eastern	36,000	.....	36,000	37,800
Florida	1,000	.....	1,000	1,000
Illinois	211,500	.....	211,500	213,100
Indiana	33,200	.....	33,200	33,000
Kansas	†302,300	.....	†302,300	†280,035
Kentucky	56,600	.....	56,600	57,100
Louisiana	990,550	147,500	1,138,050	1,134,000
North	105,550	6,250	111,800	111,750
South	885,000	141,250	1,026,250	1,022,250
Michigan	49,500	.....	49,500	48,800
Mississippi	146,700	4,250	150,950	150,825
Montana	82,000	.....	82,000	81,600
Nebraska	65,000	.....	65,000	65,100
Nevada	50	.....	50	50
New Mexico	291,500	8,500	300,000	296,300
North Dakota	67,000	.....	67,000	66,600
Oklahoma	†513,500	.....	†513,500	†498,000
Texas	2,500,000	100,350	2,600,350	2,607,200
Dist. 1	42,000	3,700	45,700	45,700
Dist. 2	104,000	8,400	112,400	113,550
Dist. 3	317,000	41,000	358,000	360,275
Dist. 4	177,000	15,000	192,000	193,150
Dist. 5	27,000	500	27,500	27,500
Dist. 6	113,000	8,500	121,500	120,925
East Texas field	132,000	.....	132,000	132,575
Dist. 7-B	128,000	400	128,400	127,825
Dist. 7-C	113,000	4,050	117,050	118,200
Dist. 8	1,057,000	13,000	1,070,000	1,069,425
Dist. 9	189,000	3,800	192,800	195,075
Dist. 10	101,000	2,000	103,000	103,000
Utah	108,500	.....	108,500	110,300
Wyoming	382,400	.....	382,400	385,000
Others	‡700	.....	‡700	‡700
Total U. S.	6,901,195	260,750	**7,161,945**	7,132,060
Change from previous week, up			**29,885**	
Canada	†557,400	.....	†557,400	†560,000

Same period last year (crude plus cond.) ..... 300,769,600 bbl.
Total U. S. prod.—Jan. 1-Feb. 11 ..... *303,691,200 bbl.

*Includes 9,337,370 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

CRUDE-OIL PRODUCTION



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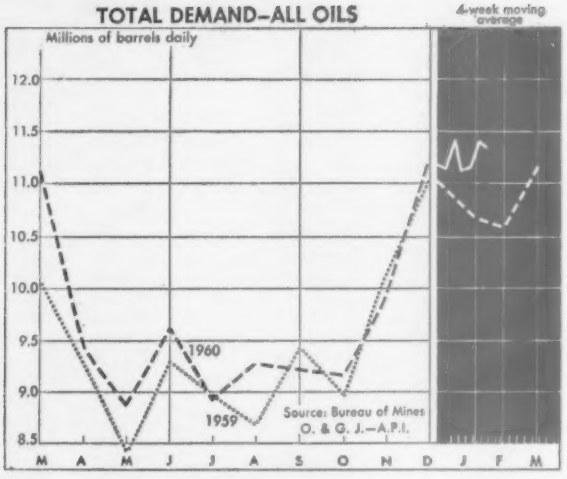

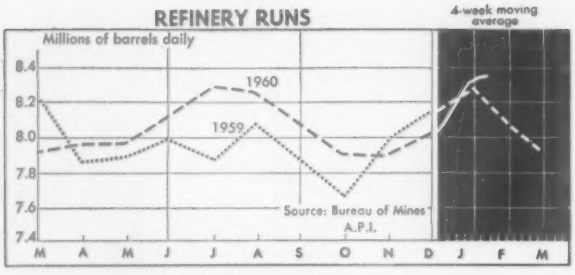

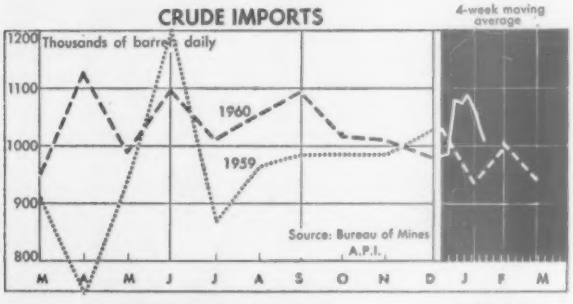

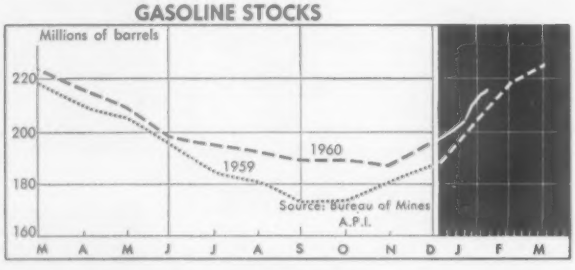

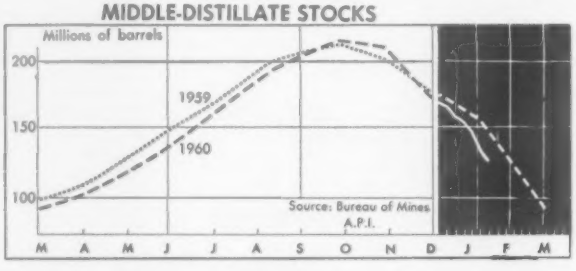

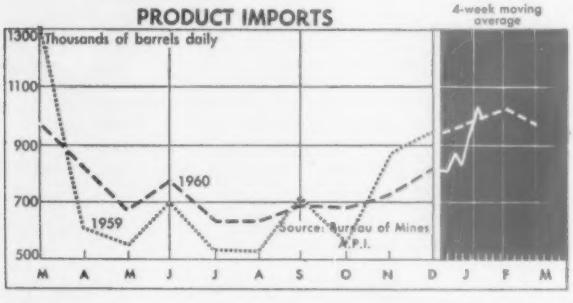

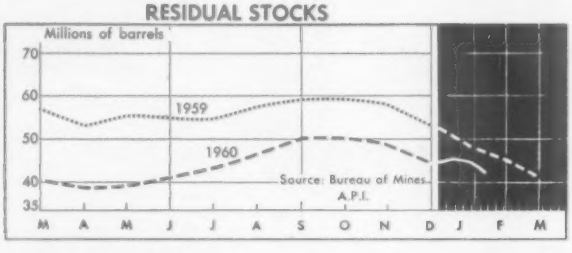

API REFINERY REPORT—FEBRUARY 10, 1961

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, February 1960 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,156	503.7	35.6	456.7	164.4	46,113	9,387	32,163	11,880	1,117	538.3	33.8	321.0	173.1
Appalachian:														
Dist. 1	98	38.7	5.1	24.6	10.3	5,808	633	2,601	525	98	40.9	3.7	21.1	14.9
Dist. 2	83	31.1	6.1	17.3	12.7	3,061	289	1,000	337	106	54.8	7.4	18.3	15.4
Ind., Ill., Ky.	1,499	716.4	68.7	359.0	200.7	37,420	4,641	16,774	5,291	1,489	769.2	68.5	314.0	206.7
Minn., Wis., Dak.	130	64.6	11.4	26.1	21.3	6,801	745	5,079	607	117	54.2	4.9	26.8	19.0
Okla., Kans., Mo.	745	421.0	16.3	224.9	27.1	19,858	1,061	9,879	773	741	410.2	15.1	186.6	31.3
Inland Texas	280	200.9	8.7	44.0	16.4	7,926	472	1,290	2,466	292	205.3	10.1	44.4	22.6
Texas Gulf Coast	2,041	938.6	175.9	582.8	166.3	32,143	2,999	9,539	5,389	1,902	956.2	120.4	453.1	140.4
La. Gulf Coast	740	360.2	73.9	222.7	50.6	11,894	1,974	3,821	1,092	663	333.0	63.1	130.3	50.0
N. La. and Ark.	113	65.9	3.3	26.7	5.9	6,359	759	2,370	141	109	66.7	7.6	22.3	6.9
Rocky Mountain:														
New Mexico	26	13.4	0.9	6.4	3.3	834	69	119	47	25	13.1	0.4	4.0	2.3
Other Rocky Mt.	287	140.2	5.4	68.6	32.6	7,186	394	2,189	997	302	141.4	4.4	70.4	35.3
West Coast	1,207	570.0	39.1	177.6	291.0	29,927	1,591	13,716	12,592	1,104	535.8	19.5	176.6	280.0
Feb. 10, 1961	8,405	4,064.6	450.4	2,237.4	1,002.6	215,330	25,014	100,540	42,137	8,065	4,119.1	358.9	1,788.9	997.9
Feb. 3, 1961	8,297	4,093.1	427.1	2,149.0	1,025.6	214,349	25,989	106,682	43,407	.....	.....	.....	.....	.....
Feb. 12, 1960	8,077	4,038.0	354.7	1,766.1	1,025.4	208,908	23,709	118,340	48,038	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Okla-homa	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Jules-burg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.96
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.75-4.80
- Middle District 4.52
- Southwest Pennsylvania 4.25
- West Virginia 4.17
- Buckeye Grade 4.08

Illinois Basin **3.00-3.05**

Foreign

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)
- Arabian, 34.0°-34.9°, Ras Tanura $1.80
- Iranian, 34.0°-34.9°, Bandar Mashur 1.78
- Iranian, 34.0°-34.9°, Abadan 1.73
- Iraq, 35.0°-35.9°, Fao 1.72
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- Qatar, 41.0°-41.9°, Umm Said 1.95

Middle East, E. Mediterranean:
- Arabian, 34.0°-34.9°, Sidon $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 36° 2.42

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Weyburn (light) 2.06
- Midale C 1.70

Venezuela:
- Cumbarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-NY, clean (ATRS + 73.75%) $4.95
★ Gulf-NY, dirty (ATRS + 42.5%) 4.06
★ Carib.-NY, dirty (ATRS — 57.5%) 1.17
PG-UK, dirty (Scale — 52.5%) (29s. 0d.) 4.06
★ Carib.-UK, dirty (Scale — 65%) (11s. 4d.) . 1.59

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- Regular (91 octane) .. 12.00-12.50
- Premium (99 octane) 14.75-15.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 11.00
- Regular (92 octane) .. 11.25
- Premium (98 octane) . 12.25

California (rack) Los Angeles:
- Regular (90 octane) .. 11.30
- Premium (95 octane) 12.30
- Premium (100 octane) 13.80

Caribbean area (cargoes):
- ★ Regular (87 octane) 9.50
- ★ Premium (97 octane) 11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 .... 10.875
- Diesel oil (58 d.i. and above) 10.50
- Distillate No. 1 ..... 10.50
- Distillate No. 2 ..... 9.50

Gulf Coast (cargoes):
- Kerosine 41-43 .... 10.25
- Distillate No. 2 .... 9.50

New York Harbor (barges):
- Kerosine 42-43 .... 11.90
- Distillate No. 2 .... 10.90
- Diesel fuel, 48-52 d.i. 11.05

Caribbean area (cargoes):
- ★ Distillate No. 2 ..... 8.625

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max 1% S) .. $1.90

Gulf Coast (cargoes):
- Bunker C fuel 2.30

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- ★ Bunker C 2.00- 2.10

California (rack):
- Bunker C fuel. Los Angeles 2.25

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FOR SALE: Two U-15s, excellent condition, complete in every detail. Inventory and price on request. Box M-269, The Oil and Gas Journal, Tulsa, Oklahoma.

WELL DRILLS, Core Drills. New and used equipment. Many sizes at bargain prices. Complete supplies. Nation wide distribution. If you want to buy or sell, contact: Pressey & Son, Pueblo, Colorado.

1 BUCYRUS ERIE 48 L Spudder in excellent condition, powered by Waukesha Diesel WAKD motor. Price reasonable. M.H.O. Drilling Co. P. O. Box 297—Phone West 8-4242, Cut Bank, Montana.

1500 FAILING long mast, kelly, propane power. Complete, core barrels, drill collars. Fred Butler, Box 481, Pueblo, Colo.

FOR SALE: 36' x 12' x 191' bolted steel compressor building and one 1500 bbl. (25' x 18') open top water tank. Located in East Texas. RAF Natural Gas Corp., 1209 Beck Building. Shreveport, La.

CLARK MA-4 Gas Compressor, 150 HP, skid-mounted with radiator and accessories; 2 I.R. XVG6 Gas Compressors; 225 HP Worthington LT6 Compressor; Pumps; Exchangers; Vessels. Brill Equipment Company, 4101 San Jacinto St., Houston 4, Texas.

1—30" x 20" New Taylor Standard Weld Tee—"Special Price."
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1—Worthington Belt Driven 5" x 9", 500 W.P. 140—GKU Waukesha, rental or sale $7,000
1—Ingersoll-Rand Belt Driven 4⅛" x 9", 1000 W.P., rental or sale $7,000
1—Clark 4" x 7", 500 W.P. $3,500
1—Ingersoll-Rand 2-stage, 120 h.p., 5¼" x 9" L.S., 3¼" x 9" H.S.
Numerous other compressors: 7", 9", 11" and 13"

Wanted
1—Ingersoll-Rand ES-1 5" x 11", 1000 W.P. Cyl.

INDEPENDENT FIELD SERVICE, INC.
Phone 425-3497 505 Montgomery St.
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HEAT EXCHANGERS
50 to 4,000 sq. ft.
VESSELS—TOWERS
12" to 8' dia.
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½MM, 2½MM, 5MM BTU
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FOR SALE gas compressors: GBU-75 Oilwell, DGE-125 Oilwell, XVG-4 Ingersoll-Rand, XVG-6 Ingersoll-Rand, RA-4 Clark. Alfred B. Kern, 305 Kennedy Building, Tulsa, Oklahoma.

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2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	8 5/6"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
50,000 ft.	18"	59#

All No. 1 Grade Plain end and cleaned.
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30.7 MM BTU/hr.	CHROME	Tubes
19.3 MM BTU/hr.	CHROME	Tubes
17 MM BTU/hr.	CHROME	Tubes
9.7 MM BTU/hr.	CHROME	Tubes
9 MM BTU/hr.	Carbon	Tubes
7.5 MM BTU/hr.	CHROME	Tubes (2)
5 MM BTU/hr.	Carbon	Tubes
2.5 MM BTU/hr.	Carbon	Tubes
2 MM BTU/hr.	Carbon	Tubes

CENTRIFUGAL BLOWER NEW 1954
7,500 CFM @ 14.4 PSIG SUCTION 42.5 PSIG
Disch. Multi-Stage 8025 RPM driven by 1250 HP Synchronous Motor 3/60/2300/1200 RPM, 5 KW Direct Conn. Exciter, Falk Speed Increaser 6.70:1 Ratio, Precooler, Intercooler, and Aftercooler.

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1 NATIONAL 3-A-6 cable tool rig, timbers, lumber and tin. 2 large Young drilling units, some tools. Bargain. 309 Thompson Bldg., Phone No. LU 7-4750.

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Thorough Knowledge of Drilling
Relocate as Service Engineer
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Excellent Opportunity in New Field
Rental Service Division.
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The Oil and Gas Journal
Tulsa, Oklahoma

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Not over thirty-five, heavy experience in Natural Gasoline Plant Design and Operation. Submit resume of experience and education. State salary expected. Inquiries kept Confidential.
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Tulsa, Oklahoma

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Refinery Superintendent, Chief Chemist, and Process Engineer with 3-5 years experience in Catalytic cracking, HF Alkylation, and Asphalt. Send complete resume of experience and salary range desire.
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Tulsa, Oklahoma

CRUDE OIL REPRESENTATIVE
Excellent opportunity for graduate Geologist or Petroleum Engineer with 5 years experience to represent progressive independent company in North Dakota.
Must be capable of dealing with producers and handling technical problems.
Salary commensurate with background and experience, plus company car and excellent fringe benefits. Married man, age 28-40.
All replies confidential.
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Tulsa, Oklahoma

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Medium-size fully integrated oil company needs an experienced professional engineer with ten or more years in the natural gas industry. This man must have the ability to initiate gas purchase contracts and negotiate for the sale of natural gas after determining the feasibility of such sales through economic studies. Familiarity with the southwestern and Rocky Mountain areas of the United States is a necessity. Submit a complete resume, including recent photograph, references, and salary requirements to: Box M-263, The Oil aand Gas Journal. All replies are strictly confidential and our employees know of this advertisement.

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B.S., M.S., Ph.D degrees in Chemical Engineering for process design and economic evaluation of refineries and petrochemical plants. Salary commensurate with qualifications and experience. Send complete resume of educational background, salary required, work experience, and personal history, including a copy of college transcript to:

Personnel Relations Department

CONTINENTAL OIL COMPANY

Ponca City, Oklahoma

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Outstanding opportunity with Independent Oil Company on West Coast for graduate Chemical Engineer with at least 5 years experience in petroleum refining and petro chemical plants. Qualifications emphasize new project planning and design with background in operations, design and technical services.

Inquiries held confidential.

Forward resume to
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The Oil and Gas Journal
Tulsa, Oklahoma

HELP WANTED

CHEMIST WITH B.S. degree to work on refined wax products and emulsions. Petroleum wax laboratory. Experience required. Please submit resumé of experience and salary expected. Box M-244, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINE ENGINEER: General duties in engineering and operating department of crude oil pipeline. Minimum 3-5 years experience. Fine opportunity. Box M-265, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING and completion Engineer—graduate engineer 4-8 years experience by expanding independent. Will be responsible for field supervision of drilling operations. Complete experience resume required, Box 746, Tyler, Texas.

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Aggressive, medium sized, integrated oil company desires geophysicist for foreign assignment. English language sufficient. Must have minimum ten years experience including supervisory and interpretation experience in Mid-Continent, Rocky Mountain, West Texas, or Canada. Must be able to integrate geological and geophysical data. Submit complete personal and technical resume to:

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The Oil and Gas Journal
Tulsa, Oklahoma

All replies held confidential.

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If you are a Graduate Chemical Engineer with 3 to 10 years experience in one or more of the following: Gas Plants, Gas Plant Design, Gas Treating, Sulphur Plants and General Refinery Process Design.

Furthermore, if you are interested in associating with a company that stresses diversification and you are interested in making a change to the West Coast, airmail your resume to:

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SITUATIONS WANTED

GEOLOGIST-PALEONTOLOGIST, B.S. 32, family, 8 years experience, subsurface, micropaleontology, administration in West Texas. Position desired; domestic, foreign, willing to work. Box M-255, The Oil and Gas Journal, Tulsa, Oklahoma.

CHIEF ENGINEER-GENERAL Manager; Drilling and/or Production Company. Graduate engineer, 14 years petroleum engineering and management experience domestic and two successful foreign contracts; 45; married, no children. James D. Nunan, 1601 Airline Park Blvd., (Metairie), New Orleans, Louisiana. VErnon 5-6667.

PETROLEUM ENGINEER, 33, 11 years drilling, production, and engineering experience on Gulf Coast. Desires job with aggressive independent. Box M-284, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION MANAGEMENT Position, secondary recovery, 37, B.S. Professional Engineer: 11 years Mid-Continent experience. Capable of ECONOMICALLY locating, acquiring, developing, and operating secondary projects. Carleton Parke, 1204-B N. Osage Drive, Tulsa, Oklahoma, Luther 7-1937.

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160 acre oil lease, Osage County, Oklahoma. Good Geology, shallow drilling. Box M-282, The Oil and Gas Journal, Tulsa, Oklahoma.

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40 ACRES Montgomery County, Kansas, diagonal off-set to new wildcat discovery, Peru Sand well. 500 ft. deep, ⅝ interest for sale $375.00 per ⅛th to drill No. 1. Reply: Box M-268, The Oil and Gas Journal, Tulsa, Oklahoma.

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(Continued from page 205)

NORTH TEXAS

King County:

Buzzard Peak 5,400-ft. Strawn field. Tom B. Medders 1. O. T. McElroy, OWWO. 1½ miles southeast of 5,736-ft. dry hole, 1 mile north of Buzzard Peak field, 20 miles southeast of Guthrie in J. G. Eustis Sur. IPP 136 BOPD, 41°, GOR 600:1. Strawn sand 5,407-13 ft. TD 5,468 ft. New oil discovery.

SOUTHWEST TEXAS

McMullen County:

William K. Davis 1 Edrington et al., Section 79, AB&M Sur., A-39, 30 miles southeast of Tilden. AOF 120 M.M.c.f.d., GLR 55.8 M.c.f. per bbl., 55.4°, shut-in pressure 2,820 psi., perf. 7,761-66 ft. Wilcox-Luling sand. TD 8,010 ft. New-field discovery.

TEXAS GULF COAST

Brazoria County:

Slick Oil Corp. 1 Jim Pekar, Lot 6, Stern & Stern Subd., J. Abbott League, A-144, 6 miles southeast of Rosharon. AOF 117 M.M.c.f.d., GLR 34,250 cu. ft. per bbl., 53.4°, shut-in TP 3,350 psi., perf. 9,947-61 ft., lower Frio. TD 10,310 ft. Discovery-well of East Chenango field.

Cameron County:

Shell Oil Co. 2 J. W. Luttes, Buena Vista Grant, A-3, 10 miles east of La Leona, AOF 70 M.M.c.f.d., GLR 6,489 cu. ft. per bbl., 50°, shut-in pressure 2,662 psi., perf 6,564-72 ft., Miocene. TD 7,500 ft. Extends Luttes field 10,550 ft. southwest.

Colorado County:

Crescent Oil & Gas Corp. 1 Kallina, I&GN Sur., A-295, 7 miles southwest of Garwood. IP 710 M.c.f.d., TP 1,570 psi., perf. 3,943-45 ft., Frio. TD 4,222 ft. New-field discovery 2 miles northeast of Garwood field.

Harris County:

Ben P. Piepgrass 1 Will Baton, Reels & Trobaugh Sur., A-59, 15 miles northeast of Houston. AOF 6,700 M.c.f.d., dry gas, shut-in pressure 1,268 psi., perf. 3,070-76 ft., Miocene; and 16,500 M.c.f.d., dry gas, shut-in pressure 1,438 psi., perf. 3,174-80 ft., Miocene. TD 3,560 ft. New pays in Clinton field.

Kleberg County:

Coastal States Gas Producing Co. 1 K. J. Kivlin, Lot 5, Section 39, Kleberg Town & Improvement Co. Subd., 8 miles southeast of Kingsville. IP 68 BOPD, 12/64-in., 29°, GOR 734 cu. ft. per bbl., TP 390 psi., perf. 3,909-20 ft., Koy sand. TD 8,050 ft. New reservoir and extension discovery in old Kingsville field.

Coastal States Gas Producing Co. 1 P. L. Henry, Lot 8, Section 49, Kleberg Town & Improvement Co. Subd., 8 miles southeast of Kingsville, AOF 17,500 M.c.f.d., dry gas, perf. 2,360-65 ft., Henry sand. TD 8,519 ft. New pay and extension discovery in old Kingsville field.

Liberty County:

Shell Oil Co. 1 Eli Rich-Stansbury et al., E. Miller Sur., A-910, 3½ miles south of Raywood. AOF 25 M.M.c.f.d., GLR 24.5 M.c.f. per bbl., 52.1°, shut-in TP 10,015 psi., perf 13,634-46 ft., Yegua. TD 16,009 ft. New pay and first gas production in Rich Ranch field.

Live Oak County:

Morris Cannan 1-B Josephine West McClelland, Lot 64, Kittie Block, Michael Garonick Sur., 135, 2 miles southwest of Oakville. AOF 1,600 M.c.f.d., dry gas, shut-in TP 810 psi., perf. 2,635-47 ft., Pettus sand. TD 2,674 ft. New-pay discovery in Oakville area.

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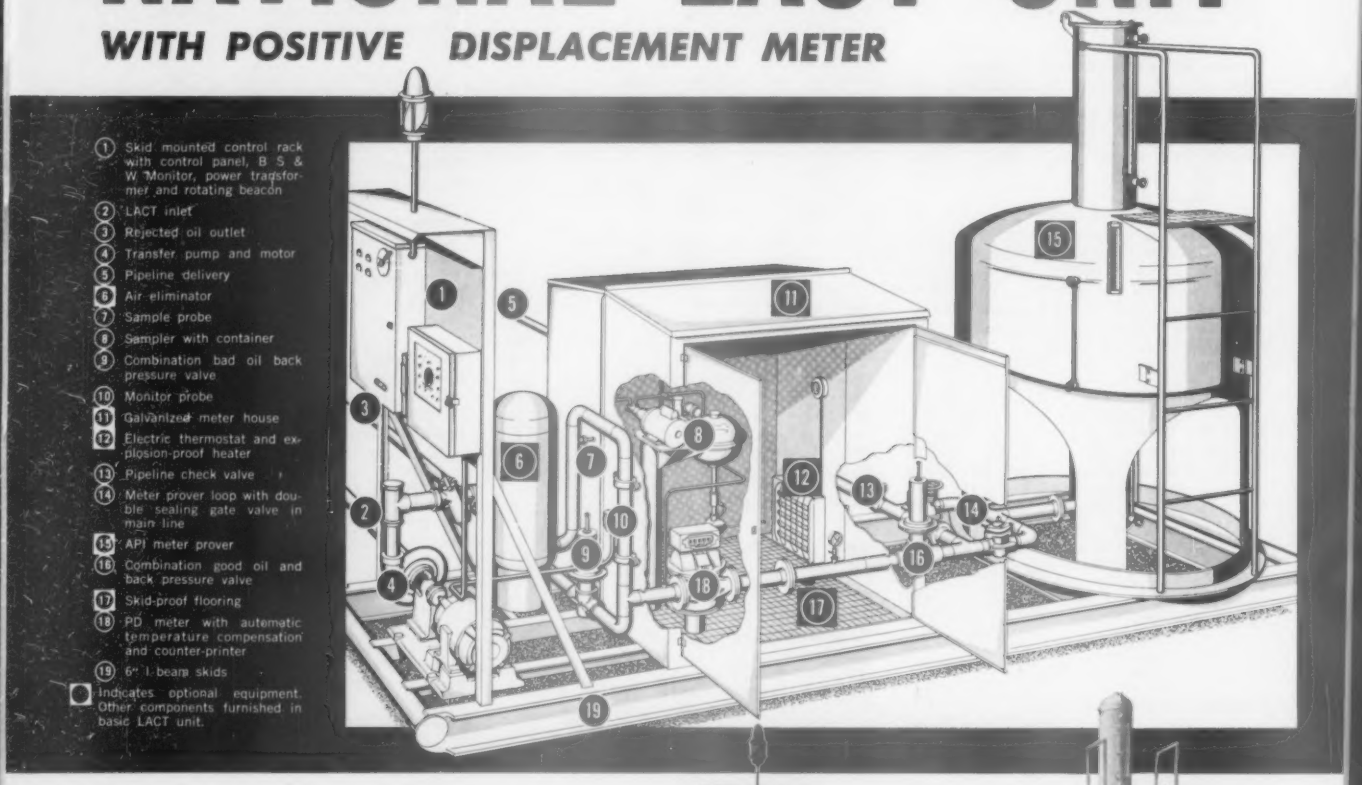
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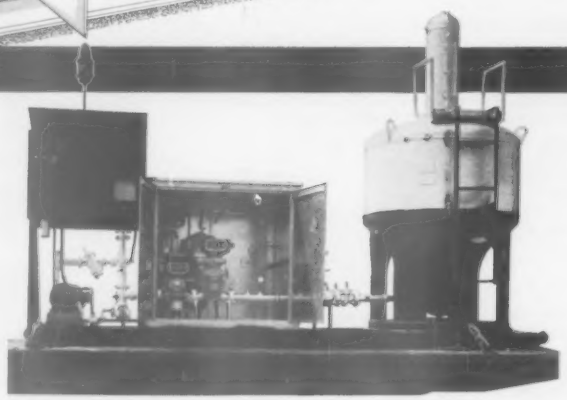

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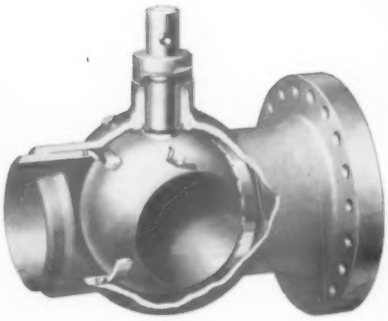

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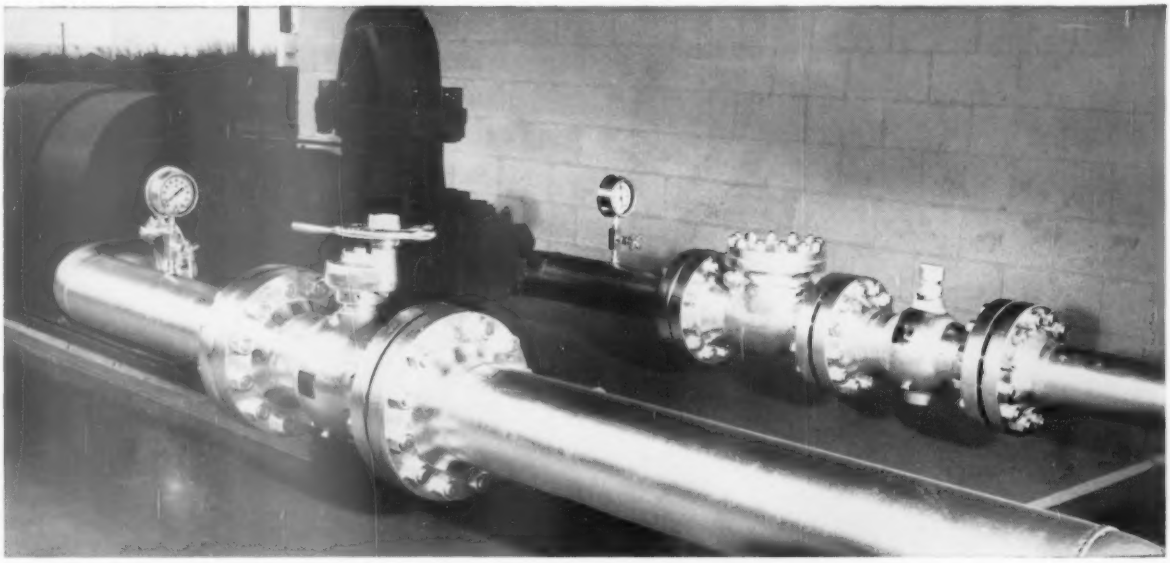

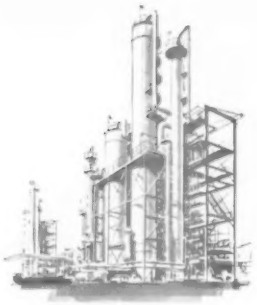

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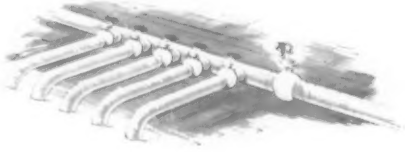

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